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JOURNAL

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THE FRANKLIN INSTITUTE,

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OF THE

State of Pennsylvania,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS AND MANUFACTURES, AND THE RECORDING OF AMERICAN AND OTHER PATENTED INVENTIONS.

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FOR THE

PROMOTION OF THE MECHANIC ARTS.

JULY, 1848.

CIVIL ENGINEERING.

Strength of Materials for Railway Bridges.

The president of the Royal Scottish Society of Arts, (G. Buchanan, Esq.,) at the request of the council, presented an important communication, at their last meeting, entitled—"An Exposition on the Strength of Materials, particularly, Cast Iron and Malleable Iron, and their Application in the Construction of Railway Bridges."

Mr. Buchanan commenced by stating, that he did not profess to communicate anything original, but would be happy if he could only draw from the stores of information which had of late years been accumulating on this subject under the hands of very eminent, scientific, and practical men, such leading facts and maxims as might prove a sure guide for our practice; and such truths, when they become known and established on the unerring grounds of experiment and calculation, could not, he thought, be too widely disseminated. The various strains might all be reduced to two kinds, according as the material is either distended or compressed by any force or pressure. From these two all others arise, and either consist or are compounded of them.—The tensile strain is the simplest of all, depending neither on the peculiar form of the materials, nor even on the length, but only on a single element—namely, the section of fracture. This peculiarity of the tensile force was explained and illustrated. In regard to cast-iron, the result of the extensive and interesting experiments of Messrs. Hodgkinson and Fairbairn was given; and it was found from the mean of 16 different trials of English, Welsh, and Scotch iron, both hot and cold blast, that this material will sustain about $7\frac{1}{2}$ tons per square inch before breaking, the weakest specimen being 6, and the strongest $9\frac{3}{4}$.

The limit of fracture, however, can never be approached with safety, not even within a long distance, seeing that this material is liable to unseen imperfections, and, above all, to snap in a moment, without distending itself, or giving any warning of danger. Malleable iron, again, is much superior in tensile strength, and, by its remarkable ductility, inspires confidence in a still higher degree; bears no less, at an average, by various experiments of Telford and Brown, than 27 tons—the weakest 24, and the strongest 29 tons; but, before the half of this load is applied, it begins to stretch, and continues stretching up to the limit of fracture; it is, therefore, not only three times stronger than cast-iron, but may be safely loaded with five times the breaking weight, or about 8 or 9 tons. In regard to the strength of compression, this depends also, as long as the length is limited, on the same element—the section of fracture; but when a long rod or slender pillar is loaded or compressed, it is liable to bend, not for want of strength, but for want of stability, the least flexure turning it off its centre, and breaking it by lateral force—deranging entirely the simple law applicable to short lengths. In regard to cast-iron, by far the most satisfactory experiments are those by Hodgkinson and Fairbairn. The mean result gives very nearly 50 tons on the square inch—the weakest 36½ tons, and the strongest 60 tons. It is thus six times stronger in compression than in distension; and hence it is peculiarly recommended for sustaining any superincumbent weight, as in the case of pillars and of bridges, provided the construction is such as to resolve the strain arising from the load into a longitudinal compression. This is often in our power by proper arrangements, chiefly giving a sufficient height and curvature to the arch; but in cases where, for the want of head-room, the arch is unduly flattened, or resolved into a straight beam or girder, the danger is that we bring the tensile force into play, and then the use of cast-iron is objectionable, or, at least, requires extreme caution. No direct experiments have been made on malleable iron of short lengths; but from some facts brought out by Mr. Hodgkinson, its strength appears much inferior to cast-iron, chiefly from ductility, whereby it gives way much sooner under a load. It will bear 27 tons, probably much more, without fracture; but with 12 tons it yields to the load, contracts longitudinally, and swells out laterally; and this is another very important fact for our guidance in the use of those different materials. In regard to stone, experiments have been generally made on specimens rather too minute. Like cast-iron, the crushing strength is superior to the tensile, and hence its adaptation for buildings, particularly bridges. Craigleith stone will bear 2½ tons on the inch, or upwards of 400 tons on the square foot—Aberdeen granite 600 tons. In regard to bricks, he had occasion to make experiments in relation to the great chimney of the Edinburgh Gas Works. It became matter of consideration, whether the ordinary brick could withstand the pressure of so lofty a column. Trials were, therefore, made with a powerful hydrostatic press, not on small specimens, but on the actual brick. The ordinary stock brick was found to bear 140 tons on the square foot, and the common fire-brick 157 tons; but the brick of which the chimney is constructed, consisting of a mixture of fire-

clay and ironstone, bore, a single brick on its bed, no less than 140 tons, equal to 400 tons on the square foot.

The effect of the transverse strain was then considered, and illustrated by various experiments and models. The strain is a compound of the tensile and compressive strain, the one part of a beam loaded in the middle being compressed, and the other distended, and the beam itself becoming a lever, and acting often with enormous power against its own strength. Hence it became easy to calculate the strength, this being in every case proportional, in the first instance, to the area of the section of fracture, and this original element, modified by the length and depth of the beam, diminishing in exact proportion to the length, and increasing in proportion to the depth.

The transverse strain acting with such severe advantage against our materials, various methods have been contrived for eluding its effects; and for these none is more remarkable than the principle of the arch, the effect of which was illustrated by experiments, and particularly the necessity in flat arches of having secure abutments to resist the horizontal thrust—and this was frequently accomplished, where there is sufficient headroom, by uniting the extremities of the arch by strong malleable iron rods, in the same manner as in the case of the roof; the feet of the rafters are united and prevented from spreading by the tie beams; and this is the principle, the securest of all, on which the great iron bridge at Newcastle, now in progress, is constructed—the object of which is to cross the river and valley of the Tyne, on the highest level of the railways on each side, so as to unite them in one uninterrupted line from London to Berwick, and unite the termini of the different railways, now separated three quarters of a mile or more, into one grand central station, a little to the west of the ancient castle. The distance between this station and the present terminus of the York and Newcastle Railway is 3457 feet, consisting chiefly of the space occupied by the bed of the river Tyne, and the steep bank on each side, well known to travelers in descending from Gateshead Fell on the south, and Dean street on the north, both to be now superseded by the smooth and level surface of the railway, and by a turnpike road running on the same bridge directly under the line of rails. The steep banks on each side are spanned by stone arches of a very substantial character, the river and low banks by six metallic arches, all of the same dimensions and structure, resting on solid piers and lofty columns of masonry. In the bed of the river the piers are laid on very solid foundations of piles and planking, with concrete—many of the piles 40 feet in length, and driven to this depth through hard gravel and sand, till they reach a bed of freestone rock. Nasmyth's celebrated pile driver is in full operation here, and with wonderful effect, and has come most opportunely in aid of the work; driving night and day, at the rate of 60 or 70 strokes a minute, the pile heads often being set on fire by the rapidity and violence of the blows of the ram. Piers laid 2 feet below water mark, and raised about 100 feet to the springing of the arches. The arches consist each of four main ribs of cast-iron, each in five segments, bolted together, and forming one entire arch, 125 feet span, and rising 17 feet 6 inches in the centre, and the level of

the rails on the upper platform $108\frac{1}{2}$ feet above the level of high water-mark of the Tyne. Depth of rib 3 feet 9 inches at the springing, and 3 feet 6 inches at the crown, with flanges 12 inches broad, external ribs 2 inches thickness of metal, internal ribs 3 inches. Total sectional area at the crown 644 square inches, which would bear with safety a load of 5000 or 6000 tons, and would form, with proper abutments, a strong arch in itself; but for the fullest security, and to prevent the possibility of inconvenience of risk from deflection or vibration, or otherwise, each rib is united at the springing by strong malleable iron bars, or ties, 7 inches broad and 1 inch deep, of the best scrap iron, and in all 24 in number. The railway is supported above the arch, and the roadway suspended from beneath, by hollow cast-iron pillars 10 feet apart, and each 14 inches square, through which are passed strong malleable iron circular bars, binding the whole into one stiff and solid mass. The sectional area of the horizontal bars is 168 square inches, which would sustain upwards of 4000 tons without breaking, and 1500 tons with perfect safety, but the whole weight of the bridge will not exceed 700 tons, leaving 800 tons of surplus strength. The railway, which is at the summit level, runs on a level 4 feet above the crown of the arched rib, and is supported in the middle by hollow cast-iron trough girders resting on the top of the pillars 10 feet apart, and united by longitudinal timbers laid with strong planking. The roadway runs nearly on a level with the malleable iron ties, leaving a space of about 20 feet clear headroom. In the whole of the work the utmost pains have been bestowed on materials and workmanship, and in making everything complete, the surfaces, which abut together, being regularly planed or turned, as in machinery; and, from all the arrangements, the most successful results may be anticipated from this bridge. The cost of the ironwork and roadway, by the estimates, comes to £112,000, and the contracts for the bridge and viaducts to above £300,000.—*Scottish Railway Gazette.* **Lond. Min. Journ.**

The General Railroad Law of the State of New York.

An Act to authorise the formation of Railroad Corporations. [Passed March 27, 1848.]

The People of the State of New York, represented in the Senate and Assembly, do enact as follows:

Section 1. Any number of persons, not less than twenty-five, being subscribers to the stock of any contemplated railroad, may be formed into a corporation for the purpose of constructing, owning, and maintaining such railroad, by complying with the following requirements: When stock to the amount of at least one thousand dollars for every mile of the road so intended to be built, shall be in good faith subscribed, and ten per cent. paid thereon, as hereinafter required, then the said subscribers may elect directors for the said company; and thereupon, they shall severally subscribe articles of association, in which shall be set forth the name of the corporation, the number of years the

same is to continue, which shall not exceed fifty years; the amount of the capital stock of the company, which shall be the actual cost of constructing the road, together with the cost for the right of way, motive power, and every other appurtenance for the completion and running of said road, as nearly as can be estimated by competent engineers; the number of shares of which the said stock shall consist; the number of directors, and their names, to manage the concerns of the company, who shall not be one half in the number of the stockholders, and shall hold their offices until others are elected; the place from and to which the proposed road is to be constructed; and each county into or through which it is intended to pass, and its length as near as may be, and the names of five commissioners to open books of subscription to the stock; each subscriber to such articles of association, shall subscribe thereto his name, place of residence, and the number of shares of stock taken by him in such company. The said articles of association may, on complying with the provisions of the next section, be filed in the office of the Secretary of State, and thereupon the persons who have so subscribed, and all persons who shall, from time to time, become stockholders in such company, shall be a body corporate, by the name specified in such articles, and shall possess the powers and privileges, and be subject to the provisions contained in titles three and four, chapter eighteen, of the first part of the revised statutes.

Sec. 2. Such articles of association shall not be filed in the office of the Secretary of State, until ten per cent. on the amount of the stock subscribed thereto, shall have been actually and in good faith paid in cash, to the directors named in such articles, nor until there is endorsed thereon, or annexed thereto, an affidavit made by at least three of the directors named in such articles, that the amount of stock required by the first section has been subscribed, and that ten per cent. on the amount has actually been paid in.

Sec. 3. A copy of any articles of association filed in pursuance of this act, with a copy of the affidavit aforesaid, endorsed thereon, or annexed thereto, and certified to be a copy by the Secretary of this State, or his deputy, shall, in all courts and places, be presumptive evidence of the incorporation of such company, and of the facts therein stated.

Sec. 4. When the certificate shall have been filed as aforesaid, the persons who shall have signed and acknowledged the same, and their successors, shall be a body politic and corporate, by the name stated in such certificate; and shall be capable of suing and being sued, and may have a common seal, and may make and alter the same at pleasure; and be capable in law of purchasing, holding, and conveying any real and personal estate whatever, necessary for the construction of such road, and for the erection of all necessary buildings, yards, and appurtenances for the use of the same.

Sec. 5. The commissioners for opening the books of subscription, named in the act of incorporation, shall, from time to time, after the company shall be incorporated, open books of subscription to the capital stock of the company, in such places, and after giving such notice, as a majority of them shall direct, which books of subscription shall

be kept open until all the capital stock shall be subscribed, if the corporation shall so long exist, and in case a greater amount of stock shall be subscribed than the whole capital stock of such company, the commissioners shall distribute such capital stock as equally as possible, among the subscribers, but no share thereof shall be divided in making such distribution, nor shall a greater number of shares be allotted to any subscriber than such subscriber shall have subscribed for.

Sec. 6. As soon as practicable after such capital stock shall have been subscribed and distributed as aforesaid, the commissioners to receive subscriptions thereto, shall appoint a time and place for the meeting of the stockholders to choose directors. Such meeting shall be held in one of the counties in or through which such railroad is proposed to be constructed; and notice thereof shall be given by said commissioners, by public notice to be published, not less than twenty days previous thereto, in the State paper, and a newspaper published in each county through which the said road shall be intended to run, in which a newspaper shall be published. Thirteen directors shall be chosen at such meeting, by ballot, and by a majority of the votes of the stockholders, being citizens of the United States, and being present in person or by proxy; and every such stockholder, being so present at such election, or at any subsequent election of directors, shall be entitled to give one vote for every share of stock which he shall have owned for the thirty days next preceding such election; but no stockholder shall vote at any such election, upon any stock, except such as he shall have owned for such thirty days. No person shall be a director, unless he shall be a stockholder, owning stock absolutely and in his own right, and qualified to vote for directors at the election at which he shall be chosen, nor unless he shall be a citizen and resident of this State; and at least seven of the directors shall, at the time of their election, be residents of the counties in or through which the route of such railroad shall run. The directors shall be directors for one year, and till others are elected in their places.

Sec. 7. The commissioners named in the last preceding section, shall be inspectors of the first election of directors, shall openly count the votes, and declare the results, and shall, within ten days thereafter, file a certificate thereof, subscribed by them, or a majority of them, in the office of the Secretary of State, and in the office of the clerk of each county, in or through which such railroad shall be proposed to be constructed, and shall also deliver to the treasurer of such company all moneys received by such commissioners, on subscriptions to such capital stock, and all books and papers in their possession, relating to such subscriptions. All subsequent elections shall be held at such time and place, in one of the counties through which such railroad shall pass, as shall be directed by the by-laws of the company, and the provisions of the second article of the second title of the eighteenth chapter of the first part of the revised statutes shall apply to corporations formed under this act.

Sec. 8. In case it shall happen at any time, that an election of directors shall not be made on the day designated by the by-laws of said company, when it ought to have been made, the company, for that

reason, shall not be dissolved, if, within ninety days thereafter, they shall hold an election for directors, in such manner as shall be provided for by the said by-laws. There shall be a president of the company, who shall be chosen by and from the directors, and also such subordinate officers as the company, by its by-laws, may designate, who may be elected or appointed, and required to give such security for the faithful performance of the duties of their office, as the company, by its by-laws, may require.

Sec. 9. It shall be lawful for the directors to call in, and demand from the stockholders respectively, all sums of money by them subscribed, at such times, and in such payments or instalments, as the directors shall deem proper, under the penalty of forfeiting the shares of stock subscribed for, and all previous payments made thereon, if payment shall not be made by the stockholders within sixty days after a personal demand or notice requiring such payment, shall have been published, for six successive weeks, in a newspaper published in each county through which said road shall be laid out, in which a newspaper shall be published.

Sec. 10. The directors of such company shall have power to make by-laws for the management and disposition of stock, property, and business affairs of such company, not inconsistent with the laws of this State, and prescribing the duties of officers, artificers, and servants, that may be employed, for the appointment of all officers, and for carrying on all the business within the objects and purposes of such company.

Sec. 11. The stock of such company shall be deemed personal estate, and shall be transferable in the manner prescribed by the by-laws of the company; but no shares shall be transferable until all previous calls thereon shall have been fully paid in, or the said shares shall have been declared forfeited for the non-payment of calls thereon. And it shall not be lawful for such company to use any of their funds in the purchase of any stock in their own, or in any other corporation.

Sec. 12. All the stockholders of any such company that shall be hereafter incorporated under this act, shall be severally individually liable to the creditors of such company, to an amount equal to the amount of stock held by them respectively, for all debts and contracts made by such company, until the whole amount of the capital stock, fixed and limited by the company, in manner aforesaid, shall have been paid in, and a certificate thereof shall have been made and recorded as prescribed in the following section; and shall be jointly and severally liable for all debts that may be due and owing to all their laborers, servants, and apprentices, for services performed for such corporation, but shall not be liable to an action therefor, before an execution shall be returned unsatisfied in whole or in part against the corporation, and then the amount due on said execution shall be the amount recoverable with costs against said stockholders. The corporation shall require sufficient security from the contractors, for the payment for all labor performed in constructing said road, by persons in their employ. All railroad companies in this State shall be liable to the day laborers employed by contractors, for labor actually performed

on their respective roads, but such liability shall not exist, unless the persons having such claim, shall, within thirty five days after the performance of such labor, notify the engineer in charge of the section on which the labor was performed, that he or they have not been paid by the contractors.

Sec. 13. The president and a majority of the directors, within thirty days after the payment of the last instalment of the capital stock, so fixed and limited by the company, shall make a certificate, stating the amount of the capital so fixed and paid in; which certificate shall be signed by the president and a majority of the directors, and sworn to by the president and secretary; and they shall, within the said thirty days, file and record the same in the office of the Secretary of State.

Sec. 14. If the directors of any such company shall declare and pay any dividend, when the company is insolvent, or any dividend, the payment of which would render it insolvent, they shall be jointly and severally liable for all the debts of the company then existing, and for all that shall be thereafter contracted, so long as they shall respectively remain in office: *Provided,* That if any of the directors shall be absent at the time of making the dividend, or shall object thereto, and shall, within thirty days thereafter, or after his return, if absent, file a certificate of their absence or objection, in writing, with the clerk of the company, and with the clerk of the county in which the principal office of said company is located, they shall be exempt from the said liability.

Sec. 15. If any certificate or report made, or public notice given, by the officers of any such company, in pursuance of the provisions of this act, shall be false in any material representation, all the officers who shall have signed the same, shall be jointly and severally liable for all the debts of the company, contracted while they are stockholders or officers thereof.

Sec. 16. No person, holding stock in any such cómpany, as executor, administrator, guardian, or trustee, and no person holding such stock as collateral security, shall be personally subject to any liability as stockholders of such company; but the person pledging such stock shall be considered as holding the same, and shall be liable as a stockholder accordingly, and the estates and funds in the hands of such executor, administrator, guardian, or trustee, shall be liable in like manner, and to the same extent, as the testator or intestate, or the ward or persons interested in such trust-fund, would have been, if he had been living and competent to act, and held the same stock in his own name.

Sec. 17. Every such executor, administrator, guardian, or trustee, shall represent the share of stock in his hands, at all meetings of the company, and may vote accordingly as a stockholder; and every person who shall pledge his stock, as aforesaid, may, nevertheless, represent the same at all such meetings, and may vote accordingly as a stockholder.

Sec. 18. Every such company, before proceeding to construct any part of their road, into or through any county named in their certificate of association, shall make a map and profile of the route intended

to be adopted by such company, which shall be certified by a majority of the directors, and filed in the office of the county clerk of such county, for the inspection and examination of all parties interested therein, and shall also deposit five per cent. on the capital stock subscribed, with the Comptroller of this State, for the use of said company, to be applied in the payment of any awards of the commissioners, appointed to ascertain the compensation for lands, real estate, or property, taken for said road, and to be paid on the order of such commissioners.

Sec. 19. Every such corporation shall possess the general powers, and be subject to the general liabilities and restrictions, expressed in the third title of the eighteenth chapter of the first part of the revised statutes, and also the special powers following, that is to say:

1. To cause such examinations and surveys for the proposed railroad to be made, as may be necessary to the selection of the most advantageous route for the railroad; and for such purpose, by their officers, agents, and servants, to enter upon lands or waters of any person, but subject to responsibility for all damages which they shall do thereto.

2. To receive, hold, and take, such voluntary grants and donations of real estate, and other property, as shall be made to it, to aid in the construction, maintenance, and accommodation of such railroad, but the real estate thus received by voluntary grant, shall be held and used for the purposes of such grants only.

3. To purchase, and, by voluntary grants and donations, receive and take, and by its officers, engineers, surveyors, and agents, enter upon, and take possession of, and hold and use all such lands and real estate, and other property, as may be necessary for the construction and maintenance of its railroad, and the stations, depots, and other accommodations, necessary to accomplish the object for which the corporation is created; but not until the compensation to be made therefor, as agreed upon by the parties, or ascertained as hereinafter prescribed, be paid to the owner or owners thereof, or deposited in court, or in bank, as hereinafter directed, unless the consent of such owner be given to enter into such possession; but nothing herein contained shall be held as repealing, or in any way affecting, the act entitled "An act authorising the construction of railroads upon Indian lands," passed May 12, 1836.

4. To lay out its road, not exceeding six rods wide, and to construct the same; and for the purposes of cuttings, embankments, and procuring stone and gravel, may take as much more land, within the limits of its charter, in the manner provided hereinafter, as may be necessary for the proper construction and security of the road.

5. To construct their road across or upon any stream of water, water-course, road, highway, railroad, or canal, which the route of its road shall intersect; but the corporation shall restore the stream or water course, road or highway, thus intersected, to its former state, or in a sufficient manner not to have impaired its usefulness, and be subject to the power vested in the canal commissioners, by the twenty-fourth section of the ninth title of the ninth chapter of the first part of the revised statutes; but nothing in this act contained, shall be con-

strued to authorise the erection of any bridge, or any obstructions across, in, or over any navigable stream.

6. To cross, intersect, join, and unite its railroad with any other railroad before constructed, at any point on its route, and upon the grounds of such other railroad company, with the necessary turn-outs, sidings, and switches, and other conveniences, in furtherance of the objects of its connexions. And every company, whose railroad is, or shall be hereafter, intersected by any new railroad, shall unite with the owners of such new railroad, in forming such intersections and connexions, and grant the facilities aforesaid. And if the two corporations cannot agree upon the amount of compensation to be made therefor, or the points and manner of such crossings and connexions, the same shall be ascertained and determined by commissioners, to be appointed by the court, as is provided hereinafter, in respect to the taking of lands.

7. To take, transport, carry, and convey persons and property on their railroad, by the power and force of steam, of animals, or any mechanical powers, or by any combination of them, and receive tolls or compensation therefor.

8. To erect and maintain all necessary and convenient buildings, stations, depots, and fixtures, and machinery, for the accommodation and use of their passengers, freights, and business, and obtain and hold the lands necessary therefor.

9. To regulate the time and manner in which passengers and property shall be transported, and the tolls and compensation to be paid therefor, but such compensation for any passenger and his ordinary baggage, shall not exceed three cents a mile, unless by special act of the legislature, and shall be subject to alteration, as hereinafter provided.

10. To borrow money to be applied to the construction of their railroad and fixtures, and purchase of engines and cars.

Sec. 20. Any number of persons, not less than thirteen, intending to organize a corporation under the provisions of this act, and every company that may hereafter organize under this act, may present a petition to the legislature, stating the place from and to which they propose to construct their road, and its location and route with reasonable certainty, or that they intend to run the said road on the most direct and eligible route between the points of terminus, and praying the legislature to determine whether the construction of the said proposed road will be of sufficient public use, to justify the taking of private property for the construction of the same; and if the legislature shall determine and decide by law, that such proposed road will be of sufficient public utility to justify the taking of private property for constructing and maintaining such road, under the provisions of this act, then such company, when organized, may enter upon, take possession of, and use all such land, real estate, and property, as may be required for the construction and maintenance of their railroad, and the convenient accommodations appertaining to the same, making compensation in the manner hereafter provided, for all land, real estate, and property, thus taken possession of and used, except such as may be volun-

tarily given to, or purchased at an agreed price by the said corporation. Whenever the said corporation shall not have acquired, by gift or purchase, any land, real estate, or property, so required as aforesaid, or which may be affected by any operation connected with such construction and maintenance, the said corporation may present to the supreme court of the district where the said lands, real estate, or property shall lie, a petition, signed by its attorney or agent, describing with convenient accuracy and certainty, by map or otherwise, the lands, real estate, or property, so required to be taken, or to be affected as aforesaid, setting forth the name and residence of each owner, or other person interested therein as owner, tenant, lessee, or incumbrancer, as far as known to such attorney or agent, or appearing of record; and praying the appointment of commissioners, to ascertain the compensation to be made to such owners and persons interested, for the taking or injuriously affecting such land, real estate, or property, as aforesaid. The court shall have satisfactory evidence that notice of an intended application, and the time and place thereof, for the appointment of commissioners of appraisement between said corporations and the owners and persons interested in such lands, real estate, and property, had been given at least ten days previously, to such owners personally, or to some person of suitable age, at their residences, or on the premises, or by the publication thereof in a newspaper printed in the county in which such land, real estate, or property may lie; such publication to be allowed only in respect to owners who shall appear, by affidavit, to have no residence in the county known to such agent or attorney, whereat such notice could be delivered as aforesaid. The court may adjourn the proceedings from time to time, shall direct any further notice thereof to be given, that may seem proper; shall hear proofs and allegations of all parties interested, touching the regularity of the proceedings, and shall, by an entry in its minutes, appoint five competent and disinterested persons, commissioners, to ascertain such compensation as aforesaid, specifying in such entry a time and place for the first meeting of such commissioners. The said commissioners, before entering upon the duties of their office, shall take the oath prescribed by the twelfth article of the constitution of this State; any one of them may administer oaths to witnesses produced before them, and may adjourn, and may hold meetings for that purpose. Whenever they shall meet to hear proofs or allegations, unless by appointment of the court, or pursuant to adjournment, they shall cause reasonable previous notice of such meetings to be given to the said owners or parties interested, or their attorney or agent, and may each of them issue subpœnas, and compel witnesses to appear and testify. They shall hear the proofs and allegations of the parties, and any three or more of them shall, after viewing the premises, without fear, favor, or partiality, ascertain and certify the compensation proper to be made to the said owners and parties interested, for the land, real estate, and property, so to be taken or injuriously affected, as aforesaid, without any deduction or allowance, on account of any real or supposed benefit or advantage, which such owners or parties interested may derive from the construction of such road; and may, in their discretion, assess

a separate, reasonable sum in favor of such owners and parties interested, or of any person appointed by the court to appear as attorney for them, for costs, expenses, and reasonable counsel fees. They, or a majority of them, shall make, subscribe, and file with the clerk of the county in which such lands, real estate, or property shall lie, a certificate of their said ascertainment and assessment, in which such land, real estate, and property, shall be described by map or otherwise, with convenient accuracy and certainty. The court, upon such certificate, and due proof that such compensation and separate sums, if any be certified, have been paid by the parties entitled to the same, or have been deposited to the credit of such parties in some bank, for that purpose approved by the court, shall make and cause to be entered in its minutes, a rule, describing such lands, real estate, and property, in manner aforesaid, such ascertainment of compensation, with the mode of making it, and such payment or deposite of the same compensation, as aforesaid: a certified copy of which rule shall be recorded and indexed in the proper clerk's or register's office, in the like manner, and with like effect, as if it were a deed or conveyance from the said owners and parties interested to the said corporation. Upon the entry of such rule, the said corporation shall become entitled to use and occupy all lands, real estate, and property described in said rule, as required to be taken as aforesaid, during the continuance of the corporation, by this or any subsequent act; and may take possession of, hold, and use the same for the purposes of said road, and shall thereupon be discharged from all claims for damages, by reason of any matter specified in said petition, certificate, or rule of court. If, at any time after an attempted or actual ascertainment of compensation, under this or any other act, or any purchase by, or donation to, the said corporation, of any lands for the purposes aforesaid, it shall appear that the title, thereby acquired, to all or any part of such lands, for the use of said road, or of said corporation, shall fail or be deemed defective, the said corporation may proceed anew to perfect such title, by procuring an ascertainment of the compensation proper to be made, to any person or persons whose title, claim, or interest in, or lien upon, such lands, shall not have been compensated or extinguished according to law, and by making payment thereof in the manner hereinbefore provided, as near as may be. And at any stage of such new proceedings, or of any proceedings under this act, the court may, by a rule in that behalf made, authorise the said corporation, if already in possession, to continue in the use or possession, and if not in possession, to take possession of, and use such premises, during the pendency, and until the final conclusion of such proceedings: and may stay all actions or proceedings against such corporation on account thereof, provided such corporation shall pay a sufficient sum into court, or give approved security, to pay the compensation in that behalf when ascertained; and in every case where possession shall be so authorised, it shall be lawful for the owner or owners to conduct the proceedings to a conclusion, if the same shall be delayed by the said company.—The said commissioners shall be entitled to receive from said corporation, their reasonable disbursements, and a compensation not exceeding two dollars for

each day actually employed by them in the discharge of their duties; such compensation and disbursements to be taxed and allowed by the court. If any commissioner, so appointed, shall die, be unable or fail to serve, the court may appoint another in his place, on reasonable notice of the application, to be approved by the court. The proceedings hereby authorised, may be had in the supreme court, in a county court where the lands lie, and all motions to the supreme court, for the appointment of commissioners, shall be made at a general or special term thereof, in such county, or in an adjacent county. The said commissioners shall file their said certificate in the county where the lands to be affected may lie, or in any adjacent county, and any clerk shall transfer the same, and proceedings connected therewith, to the clerk of the county in which the land to be affected may lie, or of any county adjacent thereto, whenever such commissioners or clerk shall be so required, by said corporation, its agent, or attorney; provided that nothing in this section contained, shall prevent the present legislature, before adjournment, from acting upon and determining the public use of such proposed railroads, as have been or may be applied for at the present session. **Amer. Min. Journ.**

(To be Continued.)

AMERICAN PATENTS.

List of American Patents which issued in the month of April, 1847, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in the Steam Hammer;* Lewis Kirk, Reading, Pennsylvania, April 3.

We make the following extract from the specification:—"The object of my invention is to apply the direct action of a steam piston, to operate the helve or lever of a hammer; and the nature of my invention consists in so combining a steam engine with the helve or lever of a hammer, and between the hammer and fulcrum, that when the steam is let in under the piston it shall lift up the hammer, and when the exhaust valve is opened, the piston will be at liberty to be carried down by the weight of the hammer—the steam and exhaust slide valves being operated each by a separate arm, on the shaft of the helve or lever, and the ends of these two arms being so connected with the valve rods, by slots, which permit the arms to move for some distance before they begin to act on the valves, so that the hammer shall nearly reach the end of its downward motion before the steam valve is opened, to admit steam to produce the next upward motion; and so of the exhaust valve during the upward motion of the hammer, the admission of steam to the steam valve being governed by a slide valve, that commands a steam port in a plate immediately above the steam valve, and operated by hand, by means of which the attendant can start and stop the hammer at any time, and at any portion of its motion. And

my invention also consists in combining with the hammer, thus operated, a slide plate with a port in it, under the steam valve, and a like plate under the exhaust valve; so that the attendant can, by sliding these plates, by a screw or lever, cause either the steam or exhaust valves to open or close, sooner or later, and thus regulate the length of stroke of the hammer."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the vertical single acting steam engine, substantially as described, when this is combined with the helve or lever of the hammer, by means of the rocker on the cross-head, and the jointed links, substantially as described. I also claim the sliding plates, or regulating valves, below the steam and exhaust valves, in combination with the engine, combined with the hammer helve or lever, substantially as described, whereby the range of motion of the hammer can be increased or decreased by the attendant, at pleasure, as described."

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2. For an *Improvement in Clocks;* Charles Kirk, Bristol, Connecticut, April 3.

The patentee says,—"The nature of my invention consists in using two pallet or scape wheels, in combination with a detached lever and balance. By this arrangement, I am enabled to put my movements into cases of much smaller dimensions, and external motion does not interrupt the time, making them much more convenient than those with a pendulum, and not as liable to be deranged."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the two pallet or scape wheels, in combination with the detached lever, substantially as set forth."

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3. For *Improvements in Pumps;* William D. Taber, Buffalo, Erie county, New York, April 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a cover to the valves of a pump, by the removal of which the valves will be released, and access had to them, combined with a contrivance that, by the bearing of the cover, may serve to keep the valves in their places,—whether this cover and contrivance for holding the valves be in one or in several parts."

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4. For an *Improvement in Pumps;* Dudley L. Farnam, City of New York, April 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the attaching the valves to the lower edge of the apertures in the side of the upper cap, and the end plate of the water-way box, in combination with the flanches that constitute the valve seats, (surrounding the induction and eduction apertures, and fitted within the cap or bonnet and the water-way box,) and with the cap plates, which give access to the valves, substantially as described, whereby the apertures in the side of the upper cap, and the end plate

of the water-way box, answer the double purpose of giving access to the valves, to take them out to repair, &c., and to adjust them to the flanches which constitute their seats, and which are separate from the parts to which the valves are attached as described."

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5. For an *Improvement in Washing Machines;* John Shugert, Elizabeth, Allegheny county, Pennsylvania, and Geo. W. Porter, Philadelphia, Pennsylvania, April 3.

The improvement consists, 1st, In making the back part of the bottom of the box horizontal, instead of a curve, as in the former case, for preventing the clothes from following the dasher, on its return from the clothes, and causing them to turn in the water with greater facility. 2d, In arranging a series of rollers on a segment of a circle, at the back part of the box, for lessening the friction and pressure on the clothes; and, 3d, In the addition of a wringing apparatus, for partially drying the clothes after being washed: the whole being arranged and combined in such a manner, as to but slightly increase the expense and proportions of the former machine.

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is arranging the rollers in the back part of the box, in the form of a segment of a circle—the lower one being on a line with the upper, in the manner and for the purpose set forth, in combination with the abrupt edge or rest, formed on the bottom of the box, for preventing the clothes from following the dasher, on its return, and causing them gradually to turn at each succeeding stroke, as described."

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6. For *Improvements in Machinery for Making Type;* Jean Constant Petyt, Paris, France, (patented in France, May 15, 1845,) April 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lateral dies with the punches and letter dies, arranged and operating substantially as described."

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7. For an *Improvement in Threshing Grain;* Edmund L. Dozier, Camden county, North Carolina, April 3.

Claim.—"What I claim as new, and desire to secure by letters patent, is the revolving drum, or cylinder, in combination with the reel, arranged and operated in the manner, and for the purpose set forth and described."

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8. For *Improvements in constructing and arranging the Slide Valves and Steam Ways of Locomotives and other Steam Engines;* John D. Beers, Philadelphia, Pennsylvania, April 3.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of arranging the respective steam ways, and the cavities in the slides, as set forth, that is to say: I claim the employment of the five openings, or steam cavities, in the valves, in combina-

tion with the three cavities in the slides, and with the tubes connecting the valves, with the valve, under an arrangement of the respective steam passages, as represented, and for the purpose set forth; by which the respective parts thereof are made to operate, and the action of the engine may be reversed, substantially as described; and this I claim, whether the arrangement made be precisely the same with those of which exemplifications are given, or be varied therefrom, whilst the same end is attained by means substantially the same."

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9. For *Improvements in the Hydraulic Ram;* Joshua L. Gatchel, Oxford, Chester county, Pennsylvania, April 3.

Claim.—"What I claim as new, and desire to secure by letters patent, is the employment of the weighted elastic diaphragm, in combination with the descending pipe, leading down into a well or other reservoir of pure water, from which a portion will be raised at every impulse of the ram. I do not claim the use of a flexible diaphragm in apparatus for raising water, but I do claim it as making a part of the combination necessary to the raising, and the preserving unmixed, of the pure water, under the arrangement set forth.

"I also claim, in combination, the particular manner of constructing the impulse valve, with the regulating plate, and the holes bored obliquely through the rim of the valve, in the manner and for the purpose set forth."

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10. For an *Improvement in Sawing Wood;* Reed B. Brown, Williston, Crittenden county, Vermont, April 10.

"The power for actuating the saw is to be derived from a weight that passes over a pulley, and that is to be wound up in a manner to be presently described. The wood to be sawed is to be placed by hand upon a wood-horse, formed in the usual manner, and is to be held down, during the operation of the saw, by means of a weighted lever, made to press on its upper part. In the arrangement of the gearing for operating the saw, there is not any thing that is substantially new, and I do not, therefore, intend to make any claim to this part; but I have added thereto an apparatus for raising the saw, and for arresting the descent of the moving weight, by the falling of the saw frame, when the piece of wood has been separated by the saw, so that the whole remains at rest, until a new stick of wood is placed upon the horse by the attendant. I have also devised a plan to facilitate the winding up of the weight, by the coiling of a rope upon a reel, which coiling takes place whilst the weight is running down; the weight may then be wound up by drawing upon the rope which has been so coiled."

Claim.—"What I claim as new, and desire to secure by letters patent, is the combination of the apparatus for elevating the saw, and arresting the descent of the weight which is to operate as a motive power, the arrangement of the respective parts being substantially the same with that herein described and represented: that is to say, I claim the

combination of the bent lever, tilting shelf, weight, cord, lever and pins, cap piece and lever, with the rod connecting it to the crank."

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11. For an *Improvement in Railroad Brakes;* John Lahaye, Reading, Berks county, Pennsylvania, April 10.

The patentee says,—"The nature of my invention consists in so constructing the brakes, that a reversed motion of the wheels of the car will throw them out of gear, and prevent their acting on the wheels while the cars are moving in a backward direction."

Claim.—"What I claim as new, and desire to secure by letters patent, is the combination and arrangement of the rubbers or brakes, the rubber cases or shoes, joint pieces and bolt, with each other, and with the shaft, cams, lever, bar, and bumper, substantially in the manner and for the purpose herein set forth."

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12. For an *Improvement in Safety Traces;* Eckert Myers, New Holland, Lancaster county, Pennsylvania, April 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is adjusting the traces to suit the size of the horse, by means of shifting the metallic plates and bolts in the manner described.

"I also claim, in combination, the rings to which the harness is attached with the spring bolt and cord, arranged and operated in the manner, and for the purpose herein set forth."

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13. For an *Improvement in the Exhaust Pipe of Locomotive Engines;* Ross Winans, Baltimore, Maryland, April 10.

Claim.—"What I claim as new, and desire to secure by letters patent, is the diminution of each of the openings of the exhaust pipes of a locomotive engine, with two cylinders, while the engine is in motion, at the pleasure of the engine man, and where the exhaust pipes discharge themselves through a mouth-piece or pipe common to both, while the orifice of such common pipe or mouth-piece is, at the same time, diminished to the same or similar extent, for the purpose above set forth.

"I do not claim the diminution of the orifice of the pipe common to both exhaust pipes, or the diminution of the orifices of pipes where they discharge their steam separately into the chimney, for a patent for such an invention has already been granted to me; but I do claim the diminution of the orifice of the common pipe or mouth piece, in combination with the diminution, at the same time, of the openings of the two exhaust pipes, before they are united in the common pipe.

"I also claim as new, the mode of doing this, by the use of the wedge-shaped plates, hereinbefore described, acting in the manner described."

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14. For an *Improvement in Padlocks;* Benjamin Chambers, (assignor of Joanna Chambers,) Washington, D. C., April 10.

Claim.—"What I claim as new, and desire to secure by letters pat-

ent, is the manner in which I have combined and arranged the levers, or either of them, and the lever, the former within the body of the lock, and the latter within the barrel of the key, so as to be operated on the slide of the key, in the manner described, which slide liberates the catches from the hasp of the lock, as set forth; the whole combination and arrangement being the same with that fully made known. And this I claim, whether the respective parts be made precisely in the forms represented and described, or in any other that constitutes a lock and key, that are substantially the same in their principle of action, effecting the same end by means essentially the same."

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15. For an *Improvement in Hinges;* Thomas Peck, Syracuse, New York, April 10.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the combination of the curved adjustable inclined plane, of the form set forth, secured to the casing, with the arms, and roller, attached to the door, substantially in the manner set forth, for the purpose of closing the door when left ajar, retaining it when closed, and also retaining the same when thrown wide open, in the manner described."

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16. For an *Improvement in Reciprocating Saw Mills;* Jacob Kunsman, Reading, Pennsylvania, April 10.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the combination of the rollers, attached to the feeding hand, and the chain or inclined plane, arranged in the manner, and for the purpose above specified."

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17. For an *Improvement in Bedstead Fastenings;* Daniel Ball, Albany, New York, April 10.

The patentee says,—" The nature of my invention consists in constructing a cheap fastening, that can be readily applied, and permits the bedstead to be easily taken down or set up, while, at the same time, it binds the rails firmly to the posts, making a close and permanent joint, and preventing a harbor for bugs, &c."

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the combination of the corner or angle iron, and wedge, for fastening bedsteads, substantially in the manner and for the purpose set forth."

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18. For an *Improvement in an Apparatus for Closing Doors, Gates, &c.;* Daniel Ball, Albany, New York, April 10.

The purpose of this invention, we are told, is that of raising doors, gates, and blinds upon their hinges, as they are opened, and afterwards closing them; and also that of holding them open if desired.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the application of the rod and sockets, or fastenings,

as described, to doors, gates, and blinds, in such a manner that, when one socket is fastened to the door, gate, or blind, and the other to the casing, the rod will stand obliquely across the joint, for the purpose and substantially as described."

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19. For an *Improvement in Hinges;* Wendell Wright, Cincinnati, Hamilton county, Ohio, April 10.

Claim.—"What I claim as new, and desire to secure by letters patent, is the within described combination of apparatus for the uniting to the office of hinge, those of the manipulation of the shutter, when the sash is closed, by arrangement of spiral, and the connecting lever with its appurtenances of link, screw-handle, &c., after the manner or principle fully described."

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20. For an *Improvement in Lasting Boots and Shoes;* Benjamin Livermore and Nathan F. English, Hartland, Windsor county, Vermont, April 17.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the adjustable frame for lasting boots and shoes, consisting of the sliding adjustable plates, and the frame upon which they slide, and, in combination therewith, the adjusting spring and cross-piece attached thereto; the whole being operated and employed substantially in the manner described."

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21. For an *Improvement in Printing Certain Colors on Calicoes, &c.;* Bennet Woodcroft, Manchester, England, (English patent dated June 22d, 1846,) April 17.

"My invention," says the patentee, "consists in the application of an improved gas apparatus to a calico printing machine, which apparatus contains the artificial atmosphere or gas, deprived of, or devoid of, free oxygen, with which the whole room has heretofore been filled, in which the operations have been carried on, and which apparatus is made to deliver or distribute the said gas on the color used on the fabric, (whilst it is being printed with de-oxydized indigo, to produce a blue color, or with de-oxydized indigo, combined with other materials, to produce other colors,) wherever it is desirable to displace the atmospheric air, or to prevent its injurious action on the color or fabric, without involving the necessity of placing the printing machine, the fabric to be printed, the printing materials, and the workmen, in a room or chamber filled with the artificial air or gas, as heretofore practised."

Claim.—"Having thus described the nature of my said invention, and the best means I am acquainted with for performing the same, I would observe that other arrangements of printing machinery may be used; and that I do not confine myself to the exact details of the gas apparatus, herein shown and described, which may be either attached to, or detached from, the printing machine, and also that any other

suitable artificial atmosphere, which is devoid of, or deprived of, free oxygen, may be used in place of coal gas, for filling the chamber, and thereby displacing and excluding atmospheric air, during such parts of the process of printing, in such colors as aforesaid, as may be desirable.

"But what I claim as my invention, is such an application of gas apparatus to calico printing machinery, for producing the colors I have named, as will cause coal gas, or any other suitable gas, deprived of, or devoid of, free oxygen, to be delivered or distributed upon the color, and the fabric, under operation in manner aforesaid, to the exclusion or displacement of atmospheric air, so as to prevent the injurious effects, arising from the presence of oxygen, at certain parts of the process, without exposing any part of the printing machine, or fabric, to the action of the gas, except where its presence is actually useful to the production of the effect required, and without the necessity of the workmen employed, performing their operations in a room or chamber filled with such gas as aforesaid, which has been the case heretofore."

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22. For an *Improvement in Shaping Hats;* Francis Degen, City of New York, April 17.

Claim.—"I claim the placing a changeable heater in the space of the stand, to act in conjunction with a curling cloth, above the heating apparatus, in combination with the adjustable curler or former piece, and the means of holding that in place, for use, substantially as described and shewn."

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23. For an *Improvement in Hinges;* Oliver Judd, Cherry Valley, Otsego county, New York, April 17.

We are told in the specification, that, "By this improvement, the hinges are made stronger, with the same weight of metal, and are fastened more firmly to the wood, and with less trouble, than in the common way, with screws, and the expense of the screws saved."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the fashion or form of the wings of the hinges, by forming tenons at the ends of the wings, and making a crook or bend in the said wings, so that the tenons are fastened, with a wedge or key, into mortices made in the edge of the doors and door casing, the other part of the wings resting in notches or channels, cut from the said mortices to the face of the door, and the said door casing, as herein described."

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24. For an *Improvement in Compressing Cotton Bales*; Augustus Devall, New Orleans, Louisiana, April 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of equilateral triangular levers, in combination with ordinary levers of the second order, the latter to be operated upon by direct application of steam power, for the purpose of compressing cotton bales, in such a manner that the increase of power,

by means of the combination, shall be equal to the increased resistance of the bale cotton, undergoing the pressure necessary to reduce it to as small a compass as may be required."

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25. For an *Improvement in Bearings for Axles and Wheels;* Uriah A. Boyden, Boston, Massachusetts, April 17.

The patentee says,—"The nature of my invention consists in sustaining axles, shafts, or spindles, and whatever else may press them downwards or longitudinally, by a bearing which can lean or incline freely in every direction, so as to adjust itself to any position or inclination of the shaft, and thereby prevent any binding of the bearing, and to secure the resting of the axle on a sufficiently large surface to prevent rapid wearing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of sustaining axles, shafts, and spindles, and whatever else may press them downwards or longitudinally, by means of the self-adjusting bearing, consisting of the first, second, and third links, as above described, whether the third link be movable or adjustable, laterally on, or in respect to whatever it rests upon, or not; and whether the first link be movable or adjustable, laterally on, or in respect to the second link, or not; and whether the second link be movable or adjustable, laterally on, or in respect to the third link, or not.

"I do not confine my claim precisely to the forms described above, but I extend it to all forms which are essentially the same in character, principle, and operation."

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26. For an *Improvement in preparing and compounding Caoutchouc or India Rubber;* William F. Ely, New York, April 17.

"My improvement," says the patentee, "consists in the treatment of the compound of calcined magnesia, or the carbonate of magnesia, and india rubber, by submitting the compound thus formed, to the action of heat or steam, at a regular temperature, by which exposure of such compound to heat, it will be so far altered in its qualities, as not to become softened by the action of the sun, or of artificial heat, nor will it be injuriously affected by exposure to cold. It will lose the adhesiveness of india rubber; it will also, in a great degree, resist the action of all the known solvents of rubber."

Claim.—"Having thus fully described the nature of the process by which I prepare my improved india rubber fabric, I do hereby declare that I do not claim the use of sulphur, as a drier, or used for the purposes above declared, nor of the application of artificial heat or steam, nor simply the compound of magnesia and rubber, but I do claim the combination of calcined magnesia, or the carbonate of magnesia, with india rubber, when the fabric is cured by the heating process, and in combination therewith, so as to form a new fabric, with a compound, either in the proportions above named, or in any other, within such limits as will produce a like result."

27. For an *Improvement in Saw Mills;* P. G. Gardiner, City of New York, April 17.

The patentee says,—"The nature of my invention consists in operating the saw, when hung and strained, in a frame or gate, by means of two cranks, at top and bottom, so that it shall gradually approach and cut into the wood, during one half of the downward stroke, and then draw back, to discharge the saw-dust from the teeth of the saw, and permit the carriage to feed or move the log forward, preparatory to the next cut."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is hanging the saw gate, in which a saw or saws can be strained, in the usual or any desired manner, to the cranks of two crank shafts, one at each end of the gate, substantially in the manner, and for the purpose specified; whereby the saw receives a motion which causes each tooth to generate a perfect circle, to give a more effective cut, discharge the saw-dust, and relieve itself for a repetition of the cut, more effectively than by any other plan with which I am acquainted."

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28. For an *Improvement in Pumps;* Geo. Page, Washington, D. C., April 17.

The patentee says,—"The nature of my invention consists in constructing a cheap and durable pump, by so arranging the parts as to be able to form the pump out of a plane scantling, grooved on one side, and covered with a plain board, and forming a suitable box thereto that shall keep perfectly packed."

Claim.—"Having thus fully described the construction of my improved pump, what I claim therein as new, and desire to secure by letters patent, is constructing the piston and packing as described, so as to cause it to pack out to the square corners, as described, while working either way, without any accurate fittings as set forth."

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29. For an *Improvement in Folding Hinge Bedsteads;* T. B. Blecker, New York, April 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a frame, hinged in the centre, and joined to the two ends of a bedstead, by irons in the shape of hooks, operating as hinges on the bolts attached to the posts, for the purpose of folding the whole bedstead together, endwise, in the manner described."

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30. For an *Improvement in Breaking Hemp and Flax;* Richard J. Gatling, Murfreesborough, Hertford county, North Carolina, April 17.

We extract from the specification the following:—"The nature of my invention and improvement consists in arranging in parallel lines, two, three, six, nine, or more, cast iron or wrought iron plates, one-

half of said plates being stationary, and one-half movable—the former being secured in a permanent frame, and the latter being attached, by a stock and connecting rod, to a revolving crank of a horizontal or other shaft, and caused to move back and forth between the stationary plates, which are arranged with their lower edges nearer together than their upper edges, for the purpose of breaking the hemp finer, as it descends in semi-circular, semi-oval or U-shaped, or other shaped spaces, notches, or cavities, or depressions, made in the upper edges of the said stationary and movable plates,—said notches or depressions being all in a straight line, transversely, when the machine is at rest, forming a transverse, semi-oval, semi-circular, or rectangular rack, with longitudinal spaces between the plates composing said racks, that gradually decrease in width from the upper to the under side, for the purpose of breaking the hemp in finer breaks, as it descends through the semi-oval rack, or square space. The bundle of unbroken hemp, to be operated on, being laid transversely in the said semi-oval rack, at the upper or wider portion thereof, and the crank shaft turned a semi-revolution, will cause the movable rack to carry the hemp against one side of the stationary rack, where the plates composing it are wider apart, and where the hemp will be broken coarsely, which is necessary at the commencement of the breaking operation; and then, by turning the crank shaft another half revolution, the motion of the sliding breakers will carry the hemp to the opposite side of the stationary rack, and break it in an opposite direction, and by repeating the operation, by a continuous revolving motion of the crank shaft, and a simultaneous descent of the hemp, it will be broken effectually to the degree of fineness required—the attendant having only to hold the bundle of hemp in the semi-oval spaces of the sliding breakers, and change the position of the same, horizontally and transversely, and vertically, during the movement, back and forth, of the breakers, when it will be seen, that the hemp will receive two breaks at each revolution of the crank, and that the machine can be operated with very little power, particularly when anti-friction rollers are placed under the sliding plates for them to move over. The hemp is then turned over to a set of revolving beaters, which knock off the broken hurds, and then applied to a series of revolving teeth, which hackle it: said beaters and teeth being fixed in the convex surface of a revolving cylinder, turned by an endless band, connected to the revolving crank shaft, or fly wheel."

Claim.—"What I claim, and desire to secure by letters patent, is the combination of the open bow or U-shaped sliding breakers or beaters, with the stationary beaters, constructed, arranged, and operated in the manner, and for the purpose above set forth—the space in which the flax or hemp is broken being open at top, and gradually lessening in size, longitudinally and transversely, as it descends, for the purpose of breaking the hemp or flax finer, as it is suffered to descend by the operator."

31. For an *Improvement in Mill Stone Drivers;* Joseph McConnell, New Brighton, Beaver county, Pennsylvania, April 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a driver, made in two pieces, attached to each other by a sliding dovetail or feather, which, while one piece is firmly attached to the spindle, the other is so constructed as to slide freely endwise, so as to allow the top stone to keep its parallel with the bedstone, whether the spindle is perpendicular with the same or not."

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32. For an *Improvement in Cultivators;* John Paterson, Medina, Orleans county, New York, April 17.

The patentee says,—"The nature of my invention consists in the arrangement of the cultivator teeth, in the following order: two in the front beam, directly front of the wheel, by which arrangement a track is made for the wheels, which lessens the liability of the wheels to be raised by passing over stones, unbroken turf, or lumps of earth, and two teeth in the centre beam, eleven inches from each wheel, which are sufficiently distant from the wheel to prevent anything from wedging between the wheels and teeth, to clog, or obstruct the motion of the wheels, and, with the arrangement of the front teeth, cannot fail to secure a uniform and even cultivation of the soil; the other three teeth are placed in the back rail; this is combined with a pair of sustaining or carrying wheels, the bearing points of which are one foot and nine inches from the outside of the front teeth, at a point on which the frame poises, so that by this arrangement, the team is relieved from any strain or load, to which they might be liable by too great a movement of the beam up and down, as the teeth cut more or less deep. By this arrangement, the necessity for guiding wheels or handles is dispensed with. In all the wheel cultivators which I am acquainted with, the teeth have been between the wheels, and so near as to be liable to clog, and do their work unevenly, in consequence of the wheels passing over obstacles, such as stone, turf, lumps of earth, &c., while they, being outside of the teeth, leave a strip of land uncultivated next to walls, stumps, fences, or ditches, of from one to two feet; all of which objections to other cultivators, are obviated by this arrangement and combination above described. The size of the wheel will allow of its being turned upside down, and drawn as a cart over grounds not to be cultivated."

Claim.—"I claim the arrangement of the cultivator teeth, as herein set forth, when such arrangement is combined with a wheel cultivator, in which the position of the wheels, with reference to the teeth, is such as herein set forth."

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33. For an *Improvement in Cast Iron Car Wheels;* Geo. W. Sizer and Henry Sizer, Springfield, Massachusetts, April 17.

This is for a modification of the double plate wheel, patented on

the 17th of March, 1838, by Truscott, Wolf, & Dougherty, of Columbia, Pennsylvania.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the casting a car wheel of two plates of metal, of the form herein set forth, united to the rim and hub, the respective plates being concave outwards, curving from hub to rim; the object of which form is to cause the plates to contract uniformly, and to enlarge the space between the same at the weakest point, as the metal cools, after casting, thereby enabling us to allow the core to remain in the wheel till it becomes perfectly cold. (The core remaining in the wheel, causes the same to cool slowly, having the effect to anneal and toughen the metal, as is well known to metallurgists.)

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34. For an *Improvement in Fire Engines;* Franklin Ransom and Dudley L. Farnam, City of New York, April 17.

The nature of this invention, we are informed, consists in arranging the pump and the engine in a horizontal position, with the piston rod extending out through the heads of the cylinder at both ends, and sufficiently far to attach it to the handles by which it is worked, when this is combined with the carriage or body of the engine, so arranged that the men who work the pump can sit, &c., and apply their strength as in the act of rowing, and thus exert much more force than in any other known way.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is arranging the pump in a horizontal position, with the piston rod extending out through both ends of the cylinder, and provided with handles, substantially as described, when this is combined with the seats on the carriage, for the men that work the pump, so that they can work the pump in a manner similar to the act of rowing, substantially as described, whereby they can exert more force and for a greater length of time, than by any other known mode of working an engine."

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35. For an *Improvement in Hinges;* James Stewart, Utica, New York, April 24.

"The object of my invention," says the patentee, "is to fasten window shutters and blinds, when open or closed, without the necessity of opening the window, and to fasten or hold the shutter or blind, when thrown open, near the outer edge thereof, as well as at the hinges, to prevent the fastenings from being broken by the wind, aided by the leverage of the shutter or blind, as is the case when the fastening is at the hinge alone. And the nature of my invention consists in making the faces of the knuckles of the hinges, where the two halves come together, with recesses and projections, so divided and situated relatively to each other, that when the shutters are opened or closed, the projections of the one shall be in the recesses of the other, and vice versa, and when, at any of the intermediate points, that the projections of the one shall rest and turn on the projections of the other, to admit

of the free turning of the hinges to open and close the shutters or blinds, when this is combined with a cam or eccentric, on the outer end of a spindle or arbor, which lies and turns in that leaf of the lower hinge which is attached to the window frame, and which extends from the knuckle of the hinge to the inside of the window, so that, by turning this spindle or arbor, the cam or eccentric on the end of it, shall act on and lift the other half of the hinge, and with it the shutter or blind, that it may be thrown open or closed, by any of the known modes of doing this, from the inside of the window.

"And my invention also consists in combining, with hinges thus constructed, a permanent hook and catch, attached to the wall and outside of the shutter, that may be hooked and unhooked, by the lifting of the shutter, in the manner described above."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the faces of the knuckles of the two halves of the hinge with quadrant recesses, in the manner of a clutch, to hold and prevent the shutter from turning, when either open or closed, when this is combined with the cam or eccentric, on the end of a horizontal spindle, that passes through to the inside of the window, substantially as described, whereby the shutter can be fastened and unfastened, without opening the window, as described.

"And I also claim, in combination with a hinge or hinges, constructed as herein described, the hook and catch attached to the wall and shutter, and which hook and unhook, by lifting down the shutter, to clutch and unclutch the hinges, as described."

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36. For an *Improvement in making Metallic Plate Buttons;* Lucien E. Hicks, (assignor of Junius S. Norton,) Middletown, Connecticut, April 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the circles, with their punches, pins, cams, legs, and shoes, in combination with the dies, and the feeding slide, in the manner and for the purposes herein described."

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37. For an *Improvement in Hinges;* John Peant, Washington, D. C., April 24.

The patentee says,—"The nature of my improvement consists in affixing a sliding bolt to the hinge, at or near its joint, so constructed as to embrace and sustain both parts of the hinge when open, and thus hold the blind back, without bringing any strain on the pivoting pin, by which its liability to break is obviated, and a perfect, cheap, and compact hinge is formed."

Claim.—"Having thus fully described my improvement, what I claim as new, and desire to secure by letters patent, is the combination of the bolt with the hinge, in the manner described, so that a portion of it enters between the two parts of the hinge at the joint, so as to brace on one side, while the hook on the bolt firmly secures it on

the other side, the whole being constructed substantially in the manner, and for the purpose described."

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38. For an *Improvement in Conveying the Smoke and Sparks from the Smoke Stacks of Furnaces of Engines, and Extinguishing the Sparks;* R. M. Wade, of Summit Point, Jefferson county, Virginia, April 24.

The nature of this invention consists in combining with the ordinary steam engine, a pump, for pumping the smoke and sparks from the smoke chamber, and discharging them below the engine into water, or otherwise, or whenever desired; the piston rod of said pump being connected with the piston rod of the steam cylinder, by a cross head or other suitable means, causing them to work simultaneously, by which arrangement the annoyance and danger arising from the smoke and sparks escaping from the smoke stack, as ordinarily arranged, will be removed.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is pumping the sparks from the smoke box of a locomotive engine, where the sparks are extinguished, or partially so, by the introduction of a portion of the escape steam through the cocks, substantially in the manner, and for the reasons above stated.

"I likewise claim the arrangement of the valve in the smoke stack, as constructed with the short pipe, in combination with the united steam pipes, for preventing the escape of the smoke and sparks during the operation of the pump, and, at the same time, allowing the waste steam to escape through the smoke pipe."

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39. For an *Improvement in Making Hats;* William Selpho, City of New York, April 24.

Claim.—"What I claim as new, and of my own invention, and desire to secure by letters patent, is the making a machine to form hat crowns, by the constructive combination of the platform, staves, and links, with the cylinder, spring, lever, and standard, when applied to such uses, substantially as described and shown."

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40. For an *Improvement in Manufacturing Tin and other Metal Wares;* Lester Smith, Southington, Hartford county, Connecticut, April 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of a movable gauge, in combination with two or more different thicknesses of wheels, to be attached to the common setting down machine; and by shifting the wheels or rollers, and moving the gauge, the machine is readily adjusted to any required width of seam."

41. For an *Improvement in Metallic Coffins;* Frederick Skiff, New York, April 24.

The patentee says,—"The nature of my invention consists in combining 80 parts of iron, 15 parts of zinc, and 5 parts of crystals of quartz or glass, (or I may use other proportions, producing analogous results,) which combination, when properly fused together, forms a composition or metal which will not deteriorate or oxydize, by exposure to the moisture of the earth, or the action of the atmosphere, and of making a metallic cement, composed of the filings or portions of the above composition, pulverized and mixed with sal ammoniac and water, to the consistence of an ordinary paste, and which cement, when brought in contact with contiguous pieces of said composition or metal, immediately unites the same, and more firmly, and in a shorter period of time, than any other metallic material can be united, in any air tight form, by any other agent or process, and thus rendering said composition, by the process of uniting the same by means of this cement, peculiarly and better adapted to the purpose of coffins and boxes, for the preservation of dead bodies, and other perishable substances, and vegetable matter, than any other known material, means, or process."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described composition of zinc, silex, and iron, and the making and preparing said cement, for the purpose above stated.

"And I also claim making coffins, boxes, or other vessels, of this material, for the purpose of preserving animal or other perishable substances from decay, substantially in the manner set forth; it being understood and admitted, that said compositions are more particularly advantageous and applicable to the purposes in question, and impervious to air."

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42. For an *Improvement in the mode of Gearing, for Changing the Speed of Rollers, &c.;* John Evans and James H. Thompson, Paterson, Passaic county, New Jersey, April 24.

Claim.—"What we claim as our invention, and not previously known in the above described improvement, is the mode or manner of placing several different sized wheels upon a shaft, and by means of catches, dogs, or tumblers, attached inside of the said wheels, or attached to the shaft upon which the wheels revolve, and, by means of flutes, nicks, notches, or grooves, upon the said shaft, or upon the inside of said wheels, so that said wheels are made to slide, or revolve backwards, to permit the driving wheel to slide or pass from one of said wheels to another, thus increasing or diminishing the speed, without breaking teeth, or causing the machinery or gearing to stop while the change of speed is going on."

43. For an *Improvement in Piano Fortes;* Thomas Loud, Philadelphia, Pennsylvania, April 24.

"The nature of my invention," says the patentee, "consists in the inversion of the striking or hammer action. I do this by removing what is commonly called 'the leathered hammer block,' but which I have named 'the striking block,' from the hammer, and placing it below, attaching it either to the key, or to a lever connected with the key, and affixing, by centres, to the hammer, the movable part or front of the jack, which I centre at or about three-eighths of an inch from the centre of the hammer; this I call the 'movable lifter;' it is kept to its place by a spring fastened front, so that when the key is struck, the striking block strikes and raises the movable lifter, which takes, on its centre, the hammer head to the strings, at which point the hammer is relieved, and falls from the strings, by a block striking an inclined plane on the front of the movable lifter, which presses it off, and relieves it from the striking block."

Claim.—"What I claim as my invention, and wish to secure by letters patent, is the inversion of the parts of the grand action, by 1st, The attaching, by centres, the movable lifter or front of the jack, to the hammer block, or hammer butt, without the striking block forming part of the said movable lifter, or of the hammer butt; and, 2d, The placing the striking block, (which, in ordinary grand actions, is a part of the hammer,) below aforesaid movable lifter, in connexion with the key, either in contact with the key, or by a lever connecting it with the same."

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44. For an *Improvement in the mode of Confining Bits to their Stocks;* Manasseh Andrews, Bridgewater, Massachusetts, April 24.

The patentee says,—"In my improvement, the use of springs is entirely superseded, and the confining catch, which engages with the notch on the bit, is cast near the end of a thumb-lever, which is arranged so as to play loosely in a suitable slot in the socket of the stock. Near that end of this lever to which the thumb is applied, is cast an external stud, which works, or fits, into a spiral or inclined slot, formed in a turning collar, which collar is fitted to, and turns on, the socket aforenamed."

Claim.—"What I claim as my invention, and desire to have secured by letters patent, is the mode hereinabove described, of confining a bit to its stock, viz: by means of a thumb-lever, having a catch and stud as described, in combination with a turning collar, having a spiral slot, as set forth, the whole arrangement and operation being substantially as hereinbefore specified."

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45. For an *Improvement in Presses;* Lorenzo Potter, Warren, Trumbull county, Ohio, April 24.

This improvement in the toggle joint lever press, consists in an improved manner of operating the levers, by means of ratchet bridles and hand levers, combined with the toggle joints.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of operating and retaining the toggle joint levers, by means of the hand levers, and the ratchet bridles combined with each other, and with the toggle joints, in such a manner that each hand lever acts equally upon both toggle joints, substantially as herein set forth.

"I also claim the combining the toggle joint levers with the platen, through the medium of the conical-sided notched feeding follower, substantially in the manner and for the purpose herein set forth."

List of American Patents which issued in the month of July, 1842, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Straw Cutters;* J. W. Webb, Mount Morris, Livingston county, New York, July 2.

Claim.—"What I claim as new, and wish to secure by letters patent, is the manner in which I have combined and arranged the vibrating frame, with its cutting knife, and the lever, with its connecting rods, so as to effect the cutting by their conjoint action, in the manner described. I also claim the special arrangement of the feeding apparatus, consisting of the pall on the vibrating frame, operating upon the ratchet wheel, and its whirl, and upon the whirl upon the gudgeons of the upper feed roller, which rise and fall in the curved slots, in the manner described."

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2. For an *Improvement in Cutting Nails;* Frederick J. Ayres, Roxbury, Norfolk county, Massachusetts, July 2.

Claim.—"Having thus described my improvement, I shall claim the gauge applied to the rear of the cutting knife, in combination with the die, for the purpose of retaining the nail against the adjacent face of the die, when separated from the strip, and whilst being conveyed by the cutting knife, down upon the shelf, and also for holding said nail against said face of the die, until it is received by one of the nippers; the same being constructed and operating substantially as above explained. Also the angular shelf, upon which the nail is deposited by the cutting tool, and sustained by the nipper and griper during the heading operation, in combination with the gauge, and the die, the said angular shelf being formed as above set forth, by which peculiar shape the nail, by reason of its heaviest part resting beyond the shelf, is caused, by the action of gravity, to fall from said shelf on recession of the griper, the whole being constructed and operating substantially in the manner, and on the principles hereinbefore explained."

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3. For an *Improvement in Cooking Stoves;* Moses Bartholomew, Vershire, Orange county, Vermont, July 2.

The patentee says,—"My stove is constructed with two separate

fire chambers or furnaces, which I call the front and rear fire chambers or furnaces, in either of which a fire may be made separately; the rear furnace is further capable of being divided into two, by means of a swinging partition, and thus admitting of a fire being made in one half of the rear furnace or fire chamber, only. I usually employ three boilers or other cooking utensils in my stove, one of them, which may be of a large size, over the front, and two of them over the rear fire chamber. There is not any oven in the body of my stove, but I combine therewith, in the rear of my rear fire chamber, any elevated oven, constructed in a manner very similar to the elevated ovens previously used."

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular manner in which I have combined and arranged the respective parts thereof, as herein set forth, that is to say: I claim the combining of the rear and fore fire chambers, by means of a top plate, furnished with elevated collars, and with flues formed therein, for the passage of heated air from the fore to the rear fire chamber, and to an elevated oven; the rear fire chamber being also provided with a swinging partition, by which it may be divided into two parts, in the manner, and for the purpose described.

"I claim also the manner of constructing an elevated oven, with one of its heads hinged to the exterior case of said oven, by which means the flue space is completely exposed, and may be readily cleaned.—And it is to be distinctly understood, that I do not claim the combining, in one stove, of two separate furnaces, in either of which a fire may be made at pleasure, as in itself new, and as of my invention, this having been previously done, but not under any arrangement of parts similar to that devised by me, and herein set forth; but I limit my claim in such a stove, to the particular manner of combining and adapting the particular parts thereof, substantially in the manner herein made known."

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4. For an *Improvement in Cutting Match Splints;* Chauncey E. Warner, (assignor to John H. Stevens,) City of New York, July 2.

Claim.—"I claim the application, and the use of the cutting cylinder, or cylinders, in combination with the cutting knife, or other instrument operating substantially the same as herein described. 2d, I claim the application and use of the cylinders or cylinder, with a cutting tool, as above set forth, in combination with the said mode, or other mode substantially the same, for the purpose of feeding the wood, when operated upon as herein described. 3d, I claim the application and use of the cutting cylinders, in combination with a stem or shank, having vertical edges, for the purpose of dividing the wood, substantially the same as herein set forth."

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5. For an *Improvement in Telegraphs;* Samuel Frew, Elizabeth, Allegheny county, Pennsylvania, July 2.

The patentee says,—"The nature of my invention consists in a movable wire, or other agent, in a state of tension, so as to be equiva-

lent to a continuous rod without elasticity, extending from one place to another, by the moving of which wire a given space, at one extremity, a movement over an equal space is produced at the other, and, by the use of dials and indices, at the extremities, the simultaneous movement of these indices are made to coincide in their notations, by pointing to the same word, letter, figure, sign, or emblem, in both places at the same moment."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of a wire or other movable medium, extended from one place to another, together with movable dials, or other alterative contrivances, hereinbefore described, or alluded to, by which corresponding notations are made at the same time, on the dials at the termini of the line, by means of words, figures, letters, signs, or emblems, written thereon, at equal spaces, so that the moving of the wire, or other medium, an allotted space, is made to produce accurate, intelligible, and coincident indications at the extremities, comprising under this principle, the different modifications set forth in these specifications, by which combined movements of two or more media are made to result in definite indications of fact, locality, or idea. I claim, too, as original with me, the several systems detailed in these specifications, by which the eye and ear are both notified of a call or other movement. Also the system herein set forth, by which one bell is made to serve for a number of rooms in a hotel, or other establishment. Also the system herein set forth, by which light is produced and extinguished at any given point, by the movement of a wire or other medium."

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6. For an *Improvement in Water Wheels;* A. B. Beckwith, Bath, Steuben county, New York, July 2.

Claim.—"What I claim as my invention, and not previously known, and which I desire to secure by letters patent, is constructing a water wheel in the manner above described, with any desirable number of concave or dished spiral buckets of wood or metal, and combining them with a shaft, each spiral having a separate entrance for water, at the face of the wheel, and discharging it at the sides, using it with or without the conic flanch, and the cylindrical gate, the gate being so constructed that, by raising or lowering it, the quantity of water necessary may be vented at pleasure."

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7. For an *Improvement in Lard Lamps;* Frederick H. Southworth, Washington, D. C., July 2.

The patentee says,—"The nature of my invention and improvement consists in constructing a holder for the wick, of copper, in a peculiar manner, which also acts as a conductor of the heat, and combining it with a central copper conductor, which also serves to hold or anchor the wick, and combining these with a basined cap, for holding a quantity of lard in contact with the lighted part of the wick, to cause the

wick to light speedily, before the main body of the lard or concrete substance can be converted into oil."

Claim.—"What I claim as my invention, and wish to secure by letters patent, is the peculiar form of the wick holders, in combination with the central conductor, constructed and arranged in the manner herein set forth, or in any other manner substantially the same, combined with a glass or other lamp, for burning lard or other concrete substance, to be previously converted into oil, by the conductors of heat, in contact with the flame of the lamp."

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8. For an *Improvement in Saw Mill Gates;* James Hamilton, City of New York, July 2.

Claim.—"What I claim as new, and of my own invention, is, 1st, The mode of connecting the hand gear crank handle and shaft, through the hand gear pinion, chain band, chain band gear, wheels, and guide screws to the guide blocks, and grooved slide ways, and the combination of these parts with the slide pieces and saw slings, for the purpose of enabling the attendant workman to control and direct the lateral movement of the saw, when such mode of connexion and combination is employed to effect either straight or curvilinear sawing, including any merely mechanical variations in the connecting and working parts, which shall be substantially the same in the means employed, and the effects produced. 2d, The mode of mounting the saw in the chops, in combination with the mode of connecting the chops with the slings, by the centre pins, and the combining these parts with the guide lever and fork on the double-slotted bar, for the purpose of enabling the attendant workman to direct the operations of the saw, successively, in any required lines, either straight or curvilinear, substantially as such mode of mounting, connecting, and combining the same is herein described, including such merely mechanical variations as shall be substantially the same, in the means employed, and the effects produced."

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9. For an *Improvement in the Clasp for Pantaloon Straps;* William H. Miller, City of New York, July 8.

Claim.—"What I claim as new and of my own invention, and wish to secure by letters patent, is the forming the loop of the clasp, with the back lip bent or countersunk down, to allow the back of the hook to lie fair, in combination with the mode shown and described, of making the hook with a three-fold turn to fit the loop, whether one or more clasps are used on a strap, such articles being used as attachments for parts of garments, the whole made and operating substantially as described."

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10. For an *Improvement in Tanning Leather;* Abraham Van Pelt, Bedmunster, Somerset county, New Jersey, July 8.

Claim.—"What I claim as my invention, and desire to secure by

letters patent, is the combination of the pliable moving frame, with the pressing rollers, and also with the vat, constructed and arranged substantially as herein described."

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11. For an *Improvement in Bee Hives;* James E. Ross, Mount Sidney, Augusta county, Virginia, July 8.

The patentee says,—"My invention consists in constructing a stand of any convenient size, upon four feet, the rear feet to be from one to six inches longer than the front feet, (varying according to the size of the stand,) so that the stand may have a slanting or sloping position."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the stand and the tin plate, (attached to the front of the hive,) with its appurtenances as herein set forth."

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12. For an *Improvement in Water Wheels;* Reuben Rich, Albion, Oswego county, New York, July 8.

The patentee says,—"The nature of my invention consists in receiving the water into the wheel at its periphery from the flume, by a spiral conductor, and discharging it as soon as it passes the buckets; thus giving the full action of the water, and relieving the wheel of its weight, as soon as it passes that point."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the wheel, constructed as hereinbefore described, with the spiral conductor, and tube, so as to get the full pressure of the water, while the wheel is relieved of its weight, in the manner and for the purpose set forth."

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13. For an *Improvement in the Construction of Vessels;* Elisha F. Aldrich, City of New York, July 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of constructing ships, boats, and other vessels with cases attached to the sides of the same, as described, and in which wheels, wholly or partly immersed, are made to revolve, and by which vessels are propelled."

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14. For an *Improvement in Cooking Stoves;* William Reebe, City of New York, July 8.

Claim.—"I do not claim to have invented any one of the parts employed in this stove, taken separately therefrom, as all have been more or less used for similar purposes in different ways; but what I claim as new and of my own invention, is the combination of the valves with the valves and flues for the purpose of conducting the heat over and under the oven, either to both ovens, or to one oven separately, substantially as their mode of operation is herein described and set forth, as producing a cooking stove that can easily be set in a common fire place."

15. For an *Improvement in Raising Water;* Louis Bunier of France, now residing in Philadelphia, Pennsylvania, July 8.

Claim.—"Having thus fully described the nature of my improvements in the apparatus invented by M. Ravard, for raising water, and shown the operation of the respective parts thereof,—what I claim therein as new, and desire to secure by letters patent, is, first, the combining of the condensing apparatus, as herein described, with the pneumatic apparatus as used by M. Ravard; said condensing apparatus consisting of the reservoir, the condensor, the tube surrounded by the water chest, the exhaust valves and their respective appendages, or other devices equivalent thereto, and producing the same results, by means substantially the same.

"Secondly, I claim in the hydraulic apparatus, the manner of com bining and arranging the two pipes with each other, and with the receiver, and also arranging the respective valves and pipes connected with said receiver, so as to be operated upon by the float, and of combining the whole together in such manner, as that the external air shall be admitted to press upon the column of water to be raised, and effect its ascension in the manner herein fully made known.

"I am aware that air has been admitted into the ascending pipes of pumps, and has been allowed to commingle with the water therein contained, whereby the column has been rendered of less specific gravity, and could, therefore, be raised to a greater height by atmospheric pressure, than in the ordinary lifting pump; but this device has not been applied to any useful purpose, nor does it appear to be capable of such application. It differs also materially from my mode of forcing up a column of water by atmospheric pressure; as in my apparatus it is forced up in an unbroken column, in consequence of its having acquired a momentum in its descent in the pipe, which effectually prevents the passing of the air into the column, or body, of the water, as it ascends in the pipe."

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16. For an *Improvement in Ploughs;* Samuel Myers, Marion county, Ohio, July 11.

Claim.—"What I claim as my improvement, and desire to secure by letters patent, is the mode of altering the set of the plough by means of the rods combined and operating in the manner herein set forth."

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17. For an *Improvement in the Truss;* George W. Riddle, Kingstown, Henry county, Indiana, July 11.

The patentee says.—"My said invention consists in the application of a *block* of acute convexity to the abdominal ring, by means of a branch spring let off from a large main spring which surrounds the body, with two pads attached to the ends thereof, intended to pass longitudinally between the transverse and spinous processes of the inferior portion of the lumbar vertebræ, and the superior portion of the os sacrum; the block aforesaid is intended to produce inflamma-

tory action and consequent adhesion of the parts which have been separated.

"The main spring to support the abdominal viscera, from its wanted pressure upon the abdominal ring, and to support the uterus, and the pads to afford strength and support to that part of the body to which they are applied."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the particular form of the block, and the size thereof, applied by means of a hernial branch, as above described, the semi-counter force of the main spring and the combination of the pads with the main spring, which will afford strength and support to that region of the body to which they are applied, which is generally more or less affected in cases of Prolapsus Uteri.

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18. For an *Improvement in Hydrants;* Thomas T. Tasker, Philadelphia, Pennsylvania, July 11.

Claim.—"What I claim as new, and desire to secure by letters patent, is the affixing of the whole of the acting part of the hydrant, consisting of the stop-cock, the rising pipe, the rod by which the stop-cock is turned, and their immediate appendages, to a permanent plate at the lower end of the hydrant case, furnished with studs or supports, and with a holding or set screw, or with some analogous and equivalent device, by which the said apparatus may be held in place, and by the retracting of which it may be removed; the whole being constructed, arranged, and operating substantially as herein set forth and made known."

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19. For an *Improvement in Bedstead Fastenings;* John Fowler, Pittsburgh, Pennsylvania, July 11.

The patentee says,—"The nature of my invention consists in fastening each joint of the bedstead by a metallic key and plate of a peculiar construction, so that it can be set up or taken down in a few moments with a very slight exertion, and when put together, making the joints very close and firm."

Claim.—"I do not claim to be the original inventor of the method of fastening the ends of rails to the posts of bedsteads, by having sections of screws on the ends of the rails and corresponding cavities in the posts, and turning the rails in order to draw the parts together; but what I do claim as my invention, and desire to secure by letters patent, is the construction of the key with a cylindrical end beyond the cogs for entering a circular cavity in the bottom of the mortice in the post, for strengthening the joint as before described.

"2nd, Constructing the circular cast plate with reversed segment inclined planes against which the cogs of the key act in drawing the rail and posts together, as described.

"3rd, Securing the rails and posts of bedsteads by means of separate castings of a circular and cylindrical form, constructed and arranged in the manner and for the purpose set forth."

20. For an *Improvement in Mills for Grinding Bark and other substances;* Valentine Birely, City of Frederick, Maryland; July 11.

Claim.—"What I claim as my invention, and which I desire to receive letters patent for, is—

1st, The combination and arrangement of the three grinding and hulling cylinders of different diameters, and arrangement of teeth placed over each other and revolving in opposite directions for carrying the substance to be ground or hulled from one side of the machine to the other, in combination with the three concaves in which the cylinders revolve, arranged on opposite sides of the machine, constructed and arranged in the manner set forth, to prevent the machine from becoming choked, and to cause it to grind freely, by bringing the upper ends of the concave nearly vertically over the centre of the cylinders in the manner before described.

"2nd, In constructing the lower concave with deep parallel grooves or channels between the teeth or ribs to cause the concave to discharge itself freely as above described.

"3rd, The manner of increasing or diminishing the space between the upper edge of the concave and the cylinder, by means of the combination of the turning bars or washers, screws, axle, and plate, as herein set forth.

"4th, The manner of adjusting the lower concave to the cylinder by means of the combination and arrangement of the double set of horizontal sliding plates and screws, arranged and operated as herein set forth.

"5th, The arrangement of the horizontal toothed ties forming part of the back of the hopper in the manner and for the purpose set forth.

"6th, Constructing the hawk-beak toothed cylinder with parallel longitudinal ribs between the hawk-beak teeth, notched, in the manner and for the purpose set forth."

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21. For an *Improvement in Breaking Hemp;* Geo. T. Tate and Wm. English, Frankfort, Pike county, Missouri, July 11.

The patentees say,—"The nature of our invention consists in making the beaters, by which the shives, &c., are to be beaten out of the hemp, with a swell in the middle of their length; and having them project from the surface of a cylindrical or other formed drum, by which peculiarity of form the shives of hemp are immediately spread over the whole length of the beaters, thus greatly facilitating the operation of cleaning; whereas, when the beaters are straight, as heretofore made, the hemp, when presented to the beaters, is not spread by the operation of the beaters, and hence requires much attention from the person who feeds and tends the machine."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the peculiar manner in which we have constructed the cleaner, that is to say: We claim the making of the beaters, that project from the surface of the drum of the cleaner, with a swell in

the middle of their length, by which the hemp will be spread uniformly over the beaters as described."

22. For an *Improvement in Corn Shellers;* Cyrus B. Baldwin, Cincinnati, Ohio, July 16.

The patentee says,—"When this machine is put in operation, the corn is dropped into the hopper, and falls against the wheel, where it is intantly shelled, passing by the several ribs of the stationary plate, the hollows between the ribs facilitating the operation, till it falls into the riddle; which, together with the shoe, being shaken in a longitudinal direction, throws the cob out of the machine, the corn at the same time falling through and down upon the screen board, a current of wind being kept up by the fan, it is cleaned from the chaff and other light stuff."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the stationary plate, constructed in the manner described, in combination with the shelling wheel, as herein set forth."

23. For an *Improvement in Refrigerators;* David B. Dickinson, Baltimore, Maryland, July 16.

The patentee says,—"The nature of my invention consists in constructing a circular cylinder, in the shape of a barrel or hogshead, or other shape, with a flat or oval top, with one or more doors, for the purpose of placing and removing articles to be preserved. The inner sides of the cylinder, as well as the doors, are provided with boxes or pockets, to contain charcoal or other non-conducting matter; and at the bottom of the cylinder there is also a space or box constructed so as to contain ice."

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is constructing the combined refrigerator and safe, so as to revolve on a fixed vertical shaft, for obtaining ready access to the articles placed therein for preservation, and for the purpose of ventilating the same, and likewise, so that the several parts may be readily separated from the shaft, to be cleaned, and put together with facility, in the manner hereinbefore described and set forth."

24. For an *Improvement in Manufacturing Wire Ropes;* John A. Roebling, of Saxonburg, Butler county, Pennsylvania, July 16.

The patentee says,—"The nature of my improvement consists, 1st, In the process of attaching to the ends of the single wires, which are drawn up for the formation of a rope or strand, equal weights, to be suspended freely over small sheaves or pulleys, for the support of which a frame is erected at the end of the rope-walk. While thus all the wires are subjected to a uniform tension, and can, at the same time, contract and expand with the changes of temperature, they may be twisted into a rope or strand, in the manner commonly employed in the manufacture of hemp ropes. Three or more strands thus formed

may again be drawn up, tension weights applied to their ends, and the whole twisted into a thick rope. As all the wires and strands of a rope, made in this manner, will receive a uniform tension, the greatest strength will be obtained, which can be produced by the same amount of material, when united into a solid bar.

"2d. My second improvement is the method or methods I apply for preventing the twist of the fibres of the individual wires, during the process of 'laying.' This is effected by attaching to the end of each wire or strand, a piece of soft annealed wire, which, at the same time, supports the tension weight. The consequence is, that while the rope is twisted, the individual twist of the single wires will run into the annealed wires, and leave the elastic wires of the rope itself uninjured. Or, instead of using an annealed wire, I connect the end of each wire or strand to a small swivel, which is held by a small line or rope, which passes over the pulley and supports the tension weight. The swivels, when lubricated with oil, will, by their own revolutions, allow the wires or strands to turn freely and easily.

"3d. Another part of my improvement consists in the construction of a wrapping machine, for the formation of a perfect and continuous wrapping."

Claim.—"What I claim as my original invention, and desire to secure by letters patent, is—

"1st. The process of giving to the wires and strands a uniform tension, by attaching them to equal weights, which are freely suspended over pulleys during the manufacture as above described.

"2d. The attaching of swivels, or of pieces of annealed wire, to the ends of the single wires, or to the several strands, during the manufacture of a rope, for the purpose of preventing the twist of the fibres, as described above.

"3d. The manner of constructing the wrapping machine, the head of the hull, around which the iron bar revolves by means of its collar, embracing the wire rope firmly, and bearing against the wire, which is being wound upon it; said bar bearing against the face plate of the reel, for the purpose and in the manner herein shown, and the respective parts of which are combined and arranged as above described, so as to adapt it to the particular purpose of winding wire upon wire ropes."

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25. For an *Improvement in Locking Sleds and Sleighs;* John C. Rickey, New Cumberland, Tuscarawas county, Ohio, July 16.

The patentee says,—"The nature of my invention consists in providing a lever, to be applied to each runner of the sled or sleigh, so as to check it, when going down hill, from running forward, and, when going up hill, from running back, and where the roads are sideling and icy, to keep it from running sideways."

Claim.—"What I claim as my invention, and wish to secure by letters patent, is the application to sleds and sleighs, of levers, which will operate on the same, by projecting below the surface of the shoe, and thus prevent it from running sideways, or either back or forward,

as occasion may require, by attaching said levers to the sled or sleigh, in the manner above described, or in any other way that will produce the same effect."

26. For an *Improvement in Inserting Tubes through the Ground;* Jonathan Ridgeway, City of New York, July 16.

Claim.—"What I claim as my invention, is the application or connexion of a screw to the pipe to be inserted, by which means the pipe is drawn through the ground."

27. For an *Improvement in Picking Oakum, &c.;* Otis Allen, Tewksbury, Middlesex county, Massachusetts, July 16.

The patentee says,—"In the process of picking tarred rope or junk, &c., (as the machines which have been used in the same have heretofore been constructed,) it has been necessary to boil the rope, junk, &c., for a considerable length of time, previous to passing it through the machine to be picked, which, by reason of the great expenditure of fuel, enhances the cost of the oakum, while the hot water dissolves the tar in the rope, &c., and injures the quality of the oakum when formed.

"By my improvements in the machinery, it is only necessary to soak the tarred rope, junk, &c., in *warm* water for a short time, the remainder of the operations being effectually accomplished by my improved apparatus, and more perfectly than it has heretofore been done; that is to say: the oakum that is made, is of a superior quality."

Claim.—"Having thus described my improvements in the machine for making oakum, I shall claim bruising or crushing the rope or junk, preparatory to its being operated upon by the picking cylinders, by means of a beater or dasher, in combination with the feed rollers and scraper, adjacent to it, (against which it crushes or breaks the rope,) or with such device or devices as are substantially similar, and likewise the combination of said beater or dasher, with the picking cylinder; the whole being arranged and operating substantially in the manner, and for the purpose above set forth."

28. For an *Improvement in Combining the Open Franklin, with the Elevated Oven Cooking Stove;* Abel Cornell and Hiram R. Merchant, Guilford, Chenango county, New York, July 16.

The patentees say,—"The nature of our invention consists of an open Franklin, and an elevated oven cooking stove, united back to back, and provided with a car in which the fire is placed; said car, together with the fire, is moved into either part of the stove at pleasure."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the open Franklin, with the elevated oven cooking stove, by means of the movable grate or car, and swinging back.

"We also claim, in combination with the above arrangement, the valve or damper, for the purpose of regulating the heat of the oven.

"We do not intend to limit ourselves to the exact size, form, or manner of constructing the respective parts aforesaid, but to vary them as we may find expedient, while they remain substantially the same as herein described."

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29. For an *Improvement in Cutting Pegs;* Stephen K. Baldwin, Guilford, Belknap county, New Hampshire, July 16.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is, 1st, The method of feeding the bolt, by the combination of the fluted roller, ratchet wheel, and reaching arm, and adjustable lever, connected with the vibrating knife, as above described."

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30. For an *Improvement in Water Wheels;* Eli B. Lansing, Wheeling, Indiana, July 16.

The patentee says,—"The improvement is principally in the manner of constructing the buckets, in combination with a scroll or spiral case surrounding them, for condensing the water, and causing it to act by percussion and re-action."

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is constructing the radial buckets with inclined plane ends, diverging in contrary directions, in combination with the spiral or scroll case, as herein specified and described."

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31. For an *Improvement in Building and Propelling Vessels;* Thos. L. Jones, City of New York, July 16.

The patentee says,—"My invention consists in the employment of a series of revolving cylinders, placed transversely under a vessel, for the purpose of sustaining and propelling her, the cylinders being provided with paddles, placed spirally on their surface, as hereinafter described—constituting the important feature of my invention. The platform or bottom of the vessel is supported on the journals of these cylinders, and is, consequently, elevated above the water, the cylinders above being in contact with it."

Claim.—"Having described my improvement in the method of propelling and constructing vessels, what I claim as my invention, and desire to secure by letters patent, is, 1st, Arranging the paddles on the transverse revolving cylinders, in series of reversed spirals, as described, so that the current of water thrown by the series on one end, shall be met and thrown back by the series on the other end, whether the two series be arranged on one cylinder, or on two cylinders upon the same shaft.

"I also claim the mode of steering the vessel, by means of the fore and aft, or first and last cylinders in the series, or either of them, the same being made movable, and caused to traverse, for the purpose and in the manner set forth, or in any other substantially the same."

32. For an *Improvement in the Self-Acting Safety Gauge for Steam Boilers;* John A. Roebling, Saxonburg, Butler county, Pennsylvania, July 16.

The patentee says,—"The principle of my invention consists in the application of a common conical steam gauge, such as is generally used on the high pressure boilers of the West, in one of the boiler heads, the stem of the valve being extended inside of the boiler several inches, and furnished with a head, against which the vertical and short arm of a lever will act, whose other and longer arm is supplied with a weight, which may be of the shape of a hammer; this weight being supported upon the surface of fusible metal, which is enclosed in a box, which is placed upon the top of one of the flues, so that when the level of the water sinks below the fusible metal, the rapid absorption of heat from the flue will speedily melt the alloy, which then no longer affords a support to the hammer.

"The pressure of the short lever against the valve stem, which results from the weight attached to the long lever, will now readily open the gauge, and allow steam to escape, which, by its hissing noise, will warn the engineer of the approaching danger.

"The hammer or weight should be raised again to its position, by closing the valve before the deficiency of water is supplied, so that the surface of the alloy may resume its former level, while in a state of fusion. But, in order to assist the rise of the hammer, another gauge is arranged below the first, the stem of which, when pressed, will act upon the lower arm of the lever, and must be kept in that position, until the boiler is supplied and the alloy cooled. Where there is no room for the lower gauge, it may be placed sideways, and the lower lever arm be bent to suit its position.

"To prevent the settling of dirt and sediment from the boiler water, upon the surface of the alloy, the box containing it, may be covered, but so as to leave the hammer and lever at liberty to rise and fall, and allow the water inside to communicate with that outside."

Claim.—"What I claim as my original invention, and desire to secure by letters patent, is the application of a lever, which may be in the shape of a hammer, the head of which rests on the surface of fusible metal, which is contained in a box, and secured upon the top of a flue, so that when the water in the boiler sinks too low, and exposes the alloy, this will melt readily from the heat of the flue, and allow the hammer to sink, which then, by its leverage, will open a gauge, and give alarm by the escape of steam.

"I do not claim the principle of applying fusible alloy, but only the application of a lever in the shape of a hammer, or any other convenient shape, in connexion with a gauge or gauges, to be acted upon by the melting of an alloy, the apparatus being arranged and operating substantially in the manner fully explained and described above."

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33. For an *Improvement in Tanning Leather;* Webb Wallace and Joseph Fleming, Sussex county, New Jersey, July 20.

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is the use of the machine, constructed as

before described, in the process of tanning leather, for keeping the hides alternately rising and falling in the liquor, during the process of tanning leather, as herein set forth."

34. For an *Improvement in Cutting Garments;* J. & J. F. Knowland, Brownsboro', Oldham county, Kentucky, July 20.

The patentees say,—"The nature of our invention consists in confining the starting points of the most important measures, to one and the same point on the customer, by means of confining the measuring tapes to a point, which is affixed to an apparatus, which we call the pivot measuring apparatus."

Claim.—"What we claim as our invention or improvement, and for which we desire to secure letters patent, is the plan of measuring the human form from one and the same point, to the most essential points of measurement."

35. For an *Improvement in Saw Cylinders for Cotton Gins;* Alex. Jones, City of New York, July 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described mode of mounting the saws on the bars attached to the arms of the spiders, by having the saws notched and fitted on the said bars, instead of fitting them on a shaft or cylinder."

36. For an *Improvement in Water Wheels;* Jesse Taylor, Auburn, Cayuga county, New York, July 20. (Antedated March 28.)

Claim.—"What I claim, and desire to secure by letters patent, is the combination of a wheel, constructed as aforesaid, with a cylindrical chamber or cistern, arranged within said wheel, having openings or passages, formed in the manner described, for delivering the water on the buckets of said wheel, and supplied from a reservoir placed below it—the top of said cistern being closed to allow of its operating, all as described."

37. For an *Improvement in Mills, for Grinding all kinds of Grain, &c.;* Justin Ware, Farmington, Trumbull county, Ohio, July 20.

The patentee says,—"The principle of this machine is the combination of the screw principle of Paine & Russel's patent apple grinder, caused by the spiral flutes and ridges, the breaking principle of the corn cracker, by notching half of the ridges, as described in the foregoing specification, and the coffee-mill principle, in the floats or fine teeth at the lower part of the concave and convex."

Claim.—"What I claim as my invention and discovery, and which I desire to secure by letters patent, is the combining of the above mentioned principles of the screw, formed by the spiral flutes and ridges, the breakers, by notching every alternate ridge, and the small teeth or floats at the bottom of the concave and convex, so as to perform, with one machine, the business of the common corn sheller, of the corn crack-

er, in preparing ears of corn to grind, of the common grain mill, in grinding it, and all other kinds of small grain for provender, of grinding stone coal, plaster, and potter's clay, and, by removing that part in the concave containing the small teeth, to grind apples and all other soft vegetables."

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38. For an *Improvement in Turning Fence Pickets, &c.;* Elisha Briggs, Perry, Wyoming county, New York, July 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of machinery, by which a stick of any length is carried through, in combination with the revolving cylinder, with gouges or chisels on its anterior end, so arranged that the stick may be rounded while passing through the cylinder."

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39. For an *Improvement in Manufacturing Salt;* Calvin Guiteau, Syracuse, Onandaga county, New York, July 23.

The patentee says,—"The nature of my invention consists of four boilers, set in walls made of stone and brick."

Claim.—"What I claim as my own invention, and desire to secure by letters patent, is as follows, viz:

"The manner of setting my four boilers as described, with their fixtures, for carrying out and effecting thereby the object of simplifying the mode of making more coarse and fine salt, with less labor, fuel, and expense, than has ever been done or known before in the United States. With two salting vats, of 160 feet each in length, with 3¼ cords of wood, 150 bushels are made, weighing from 70 to 80 lbs. to the measured bushel; and from the rear boilers, 50 bushels of pure fine salt, from pure saturated brine, with an overplus of brine remaining.

"Also, by the extension of the salting vats to 200 feet in length, and bringing in the steam from the two boilers, to increase and equalize the heat in the rear part of the salting vats, will greatly increase the amount of salt, with but a small addition of wood.

"Also, by the use of the condensed steam, from the rear end of the steam boxes, which, being pure water, will avoid blocking the boilers with limy incrustations, as could not be avoided by the use of the fresh water of this region of this country, being universally impregnated with lime.

"Also avoiding blocking the boilers, by keeping short of saturation, and drawing off the water with its impurities 5° from saturation, as they are driven from their suspended state, by the force of heat, and rise to the surface, and are drawn into the side vats, and saturation completed by fine salt taken from the rear boilers, where, in this manner, the last of the impurities are separated and deposited. By this process, the great difficulties of making salt are remedied, and is not only new, but the most useful of anything known in the history of salt making."

40. For an *Improvement in Water Wheels;* Samuel L. Valentine, Bangor, Maine, July 23.

The patentee says,—"The nature of my invention consists in constructing a tub-wheel, in such a manner that it can be made of cast-iron, either whole or in segments, allowing the water to escape at the periphery of the wheel, permitting the wheel to move beneath the water, and combining the power of the percussion and re-action."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the buckets, of the form described, with the beveled or inclined form of the rim, supporting the buckets, as set forth and described."

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41. For an *Improvement in Smelting Furnaces;* Jacob Van Reed Hunter, Rockland, Berks county, Pennsylvania, July 23.

Claim.—"What I claim as new, and desire to secure by letters patent, is the increasing the diameter of the interior of the furnace, above the boshes, in the manner herein set forth, and in a proportion which shall be substantially the same with that herein designated.

"I also claim, in combination with this form and enlargement of the interior, above the boshes, the particular manner in which I diminish the upper portion of the furnace, towards the tunnel head, in the proportions substantially as designated."

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42. For an *Improvement in Coupling Conduit Pipes;* Uel West, City of New York, July 23.

Claim.—"What I claim, and desire to secure by letters patent, is the mode of connecting the joints of conduits, hydrants, &c., by means of beveled flanged joints, in the manner herein described, or in any other essentially the same."

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43. For an *Improvement in Cheese Presses;* Chester Stone, F. K. Collins, and George S. Collins, Rootstown, Portage county, Ohio, July 28.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of the power of the screw and joint lever, in a self-acting press, for the purpose of pressing cheese, as herein described."

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44. For an *Improvement in the Manufacture of Collets, &c., in the Making of Buttons, and for other purposes;* Moses Ferre, Williamsburg, Hampshire county, Massachusetts, July 28.

The patentee says,—"The principal improvement in my machine consists in the manner in which I have constructed and arranged that part of the apparatus, by which the feeding of the blanks into the die box is effected, and in which they are to be operated upon, by the die and punch."

Claim.—"Having thus fully made known the manner in which I construct and arrange the respective parts of my improved machine, for forming collets, washers, and other articles, from metallic disks, for the manufacturing of buttons, or for other purposes, what I claim as new, and desire to secure by letters patent, is the manner in which I have combined and arranged the respective parts, constituting the feeding apparatus, as herein set forth; that is to say: I claim, in combination, the trough, with its follower; the gate, with its spring catch; the channel, and the cap, operated upon, and co-operating with, each other, in effecting the purpose described, and substantially in the manner herein made known."

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45. For an *Improvement in the Power Loom, for Weaving Counterpanes and other figured goods;* E. B. Bigelow, Lancaster, Massachusetts, July 28. (Antedated May 1.)

The patentee says,—"These improvements in looms consist, 1st, In the manner of strengthening the lathe, the breast beam, and the top back girth, in order to weave cloth of great width and thickness; and, secondly, In the manner of delivering out the chain, or warp, and of taking up the finished cloth, which is effected in such a manner, as to cause a given number of threads of filling to form a given length of cloth."

Claim.—"Having thus fully described the improvement in the power loom, it is to be understood that I do not claim the employment of a measuring roller, or of measuring rollers, operating upon the principle, or in the manner of that herein described, for the purpose of regulating the action of the machinery used to deliver out the chain or warp, or to regulate the operation of that employed to take up the finished cloth; but I do claim the manner herein described, of constructing and arranging the apparatus, by which the measuring roller is connected with such machinery, whether employed to deliver out the chain or warp, or to take up the finished cloth; and these I claim, whether the apparatus used for attaining the end in view, be made precisely in the form and manner herein set forth, or in any form which is substantially the same in its construction and operation.

"I also claim the herein described improvements, in the manner of strengthening the lathe, the breast beam, and the top back girth, in order to weave cloth of great width and thickness; the manner in which I have constructed and arranged the parts for effecting this object, being the introduction of one, two, or more intermediate cross frames, and one, two, or more intermediate and additional swords, which are, as I believe, altogether new and essential in the weaving of broad and heavy goods."

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46. For an *Improvement in Floating Dry Docks;* John S. Gilbert, City of New York, July 28.

Claim.—"Having thus fully described my improved floating balance dry dock, and also the mode of using it, I do hereby declare that what I claim as of my invention, and desire to secure by letters patent, is:

"First. I do not claim simply making and using camels, placed against each side of a vessel, and by which she is raised and floated over shoals, they having been used before my invention; neither do I claim making and using a floating dry dock, with tanks or trunks on each side, divided into separate compartments by tight bulk-heads, because that kind of dry dock I have patented. And further, I do not claim simply uniting the separate compartments of a float with a pump-well, by means of pipes, governed by cocks or valves, as this has been patented; but in the patent referred to, the separate compartments of a float are united with a pump-well, the dock being composed of a series of such floats, on the tops of which the vessel rests. But what I wish to claim as my invention, and desire to secure by letters patent, is the *method* of connecting all the chambers, or separate compartments, on each side of the dock, with the pump-well, by means of pipes or conductors, governed by cocks, gates, or valves, whereby all the separate compartments are made to act in concert or alone, or any number of them, in depressing or raising the dock, in manner substantially as herein described. And I wish it distinctly understood, that I claim this arrangement, whether applied to docks with two side camels united together, or to side camels disconnected.

"Second. I claim the dividing the camels into an upper and lower chamber, to hold, by means of a tight bulk-head, in the manner and for the purposes as substantially herein described.

"Third. I claim making and using gates on the sides of floating dry docks, in combination with the tanks or trunks, for the purposes, and in the manner as substantially herein described."

An Act to provide Additional Examiners in the Patent Office, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there shall be appointed, in the manner provided in the second section of the act entitled "An act to promote the progress of useful arts, and to repeal all acts and parts of acts heretofore made for that purpose," approved July fourth, eighteen hundred and thirty six, two principal examiners and two assistant examiners, in addition to the number of examiners now employed in the Patent Office; and that hereafter each of the principal examiners employed in the Patent Office shall receive an annual salary of twenty-five hundred dollars, and each of the assistant examiners an annual salary of fifteen hundred dollars: *Provided,* That the power to extend patents, now vested in the board composed of the Secretary of State, Commissioner of Patents, and Solicitor of the Treasury, by the eighteenth section of the act approved July fourth, eighteen hundred and thirty-six, respecting the Patent Office, shall here after be vested solely in the Commissioner of Patents; and when an application is made to him for the extension of a patent according to said eighteenth section, and sixty days' notice given thereof, he shall refer the case to the principal examiner having charge of the class of

inventions to which said case belongs, who shall make a full report to said Commissioner of the said case, and particularly whether the invention or improvement, secured in the patent, was new and patentable when patented; and thereupon the said Commissioner shall grant or refuse the extension of said patent, upon the same principles and rules that have governed said board; but no patent shall be extended for a longer term than seven years.

Sec. 2. *And be it further enacted,* That hereafter the Commissioner of Patents shall require a fee of one dollar for recording any assignment, grant, or conveyance of the whole or any part of the interest in letters patent, or power of attorney, or license to make or use the things patented, when such instrument shall not exceed three hundred words; the sum of two dollars when it shall exceed three hundred and shall not exceed one thousand words; and the sum of three dollars when it shall exceed one thousand words; which fees shall in all cases be paid in advance.

Sec. 3. *And be it further enacted,* That there shall be appointed, in manner aforesaid, two clerks, to be employed in copying and recording, and in other services in the Patent Office, who shall each be paid a salary of one thousand two hundred dollars per annum.

Sec. 4. *And be it further enacted,* That the Commissioner of Patents is hereby authorized to send by mail, free of postage, the annual reports of the Patent Office, in the same manner in which he is empowered to send letters and packages relating to the business of the Patent Office. Approved May 27, 1848.

MECHANICS, PHYSICS, AND CHEMISTRY.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines, by M. V. Regnault.

(Continued from Vol. XV., page 441.)

FOURTH MEMOIR.

On the Measurement of Temperatures.

" We do not as yet possess any direct means of measuring the quantities of heat absorbed by a body under given circumstances, and we recognize this absorption of heat only by the changes which occur in the state of the body, or by its dilatation. The name *thermometer* is given to the instrument whose object is to indicate the variations in the quantities of heat in any medium. These instruments are generally founded upon the dilatation which bodies undergo by the action of heat, or upon the changes in elastic force which the same bulk of a gas experiences under the circumstances to which the medium is submitted."

" A perfect thermometer would be one whose indications were always proportional to the quantity of heat which it had absorbed, or, in other words, one in which the addition of equal quantities of heat produced always equal dilatations. To fulfil this condition it is neces-

sary either that the capacity for heat, and the dilatation of the thermometric substance should remain invariable during the experiment, or that these two elements should vary strictly inversely as each other."

"Nor would the perfect thermometer yet indicate the quantity of heat absorbed by the medium under given circumstances, unless this medium presented the same advantages as the thermometric substance, that is, unless it absorbed equal quantities of heat for equal variations of temperature as noted by the thermometer."

"But a comparative study of the dilatations of different substances under the same circumstances, quickly shows that they are far from following the same law; and if we compare together the quantities of heat absorbed by these different bodies when brought successively to different temperatures measured by the dilatations of one of them, we see that these quantities are variable, and unequally variable in each one of them, without our having been able heretofore to show the relations which exist between these variations of capacity and the changes of bulk."

"The great precision which can be obtained in the construction of the mercurial thermometer, the facility with which the thermometric liquid may be obtained of the same degree of purity, and the great extent of temperature through which this liquid preserves the same state, have given to the mercurial thermometer, the preference over all other instruments of the same kind, and have caused its adoption almost exclusively for all precise experiments."

"But there is an essential condition which every apparatus for measurement ought to satisfy; it is that it should not only remain rigorously comparable with itself, that is, that it should always mark the same degree under the same circumstances, but it is moreover necessary that we should be able to reproduce it at will, and obtain always instruments rigorously comparable."

"Physical philosophers have thought that they had completely attained this end, by making the scales of the mercurial thermometers agree at certain normal temperatures which are easily reproduced and always perfectly identical; for this purpose they have adopted the constant temperature at which ice melts, and that not less constant which saturated steam presents when it exerts an elastic force of 76 millimetres. But I have shown *(Annales de Chimie et de Physique, 3d Série, tome* v, *pages* 100 *et seq.,)* that two mercurial thermometers adjusted for the same fixed points of melting ice, and boiling water under a pressure of 76 mm., may show very considerable differences in their movements beyond these fixed points, if they are not made of glass of the same nature. Even when the glasses of the reservoirs present the same chemical composition there may still be very sensible differences in their indications according to the way in which the reservoirs have been worked in the glass-blower's lamp, the molecular state of the glass, undergoing very notable alterations during this working."

"The mercurial thermometer then, as it has been constructed up to

the present time is defective in one of the most essential conditions which ought to be required of an apparatus for measurement; it cannot be always reproduced in the same state; and the different instruments of the same kind are rarely comparable with each other beyond the fixed points of their scales."

"Physical philosophers thought that they had observed that all the gases dilate exactly the same fraction of their volume at 0°, when they are carried from the temperature 0° to that of 100° (32° to 212° Fahr.). This law so remarkable for its simplicity, naturally led them to think that the dilatation of the gases ought to be in a more simple ratio to the quantities of heat than that of solids or liquids. Some, more bold, even concluded that the dilatation of gases must be rigorously proportioned to the quantity of heat, and that the gas thermometer was the true normal thermometer, to which all the phenomena of heat ought to be referred."

"We now know that this great simplicity in the law of the dilatation of the gases is far from existing. I have shown in the memoir upon the dilatation of gases that not only the different gases have not the same coefficient of dilatation, but that even for the same gas this coefficient varies with its density. The indications of gas thermometers, then, can only be considered, like those of other thermometers, as functions more or less complicated of the quantities of heat."

"But the gas thermometers present an advantage over the mercurial and in general over all liquid or solid thermometers, an advantage which arises from the greatness of the dilatation of the thermometric substance. In any thermometer formed by a liquid or gaseous substance, the indications of the instrument depend upon the dilatation of this substance, and of that of the substance in which it is inclosed. Now the dilatation of mercury is only about seven times greater than that of the glass which holds it; and the variations which we remark in the law of the dilatation of the different glasses, form very appreciable fractions of the apparent dilatation of the mercury, and consequently influence in a notable manner the indications of the instrument. In the gas thermometer, on the contrary, the dilatation of the gas being one hundred and sixty times greater than that of the glass, the variations of the law of dilatation of the different glasses no longer sensibly influence the indications of the apparatus, and do not prevent the instruments from being comparable."

"If then we wish to profit by this important property, and adopt the gas thermometer as a standard, we must study several important questions so as to fix the conditions under which the instruments will remain comparable."

"The present memoir has for its object the study of the different methods which have been imagined for measuring temperatures in experiments which require great precision. I will divide it into three parts: in the first part, I will treat of the gas thermometer; in the second, of the mercurial thermometer; and in the third, of the measurement of temperatures by means of thermo-electric currents."

Part First. Of Gas Thermometers.

"When a gas enclosed in a mathematically elastic envelope is submitted to an elevation of temperature, its volume increases and the gas retains the same elastic force. But if we prevent this dilatation of the gas, by exerting a proper degree of pressure over the whole surface of the envelope, the gas retains the same volume, but its elastic force increases.

"There are then two modes of employing a gas as a thermometric substance. The gas may be placed under circumstances such, that the pressure which retains it remains constant, and its increase of bulk be observed; or the gas may be compelled to keep the same bulk, and its increase of elastic force be examined."

"*First Method.* In order that a gas should realize the conditions prescribed by this method, which are very nearly those found in the mercurial thermometer, it would be requisite that the gas submitted always to the same pressure, should expand freely in a gauged reservoir, kept throughout at the same temperature. But these indications cannot be fulfilled in practice, at least if the apparatus is to be submitted to high temperatures."

The thermometer must therefore be composed of a reservoir which is to be exposed to the temperature which it is desired to measure, and a gauged tube, united to the reservoir by a capillary tube which removes the other from the place where the temperature is to be measured. This gauge tube fulfils the purpose of the graduated stem of the mercurial thermometer, and serves to collect the gas which the rising of the temperature drives out of the reservoir. This tube may also be kept at a constant temperature differing but little from that of the surrounding air. At any moment during the experiment the gas is composed of two parts: the first, contained in the reservoir, is at the temperature to be found, the other in the tube is at the surrounding temperature. These two portions are at the same pressure, which may be brought as nearly as is desired to that of the atmosphere. The equations derived from these conditions permit us to calculate the required temperature.

This arrangement is the one adopted by M. Pouillet, in his air pyrometer, (*Traitè de Physique, t.* 1, *p.* 266,) and M. Regnault himself employed it in his fifth series of experiments made to determine the dilatation of gases. (See page 280.) It presents a very serious inconvenience when the apparatus is to be used for the measurement of high temperatures. In fact it will easily be seen that in this case the far greater part of the air will already be in the gauged tube, and but little will remain in the reservoir, so that a further elevation of the temperature will cause but a very small portion to pass over into the tube, and this will with difficulty be measured with the proper degree of accuracy.

In fact it can be easily shown that, calling the temperature x, and the coefficient of dilatation of the gas a, the sensibility of the apparatus will vary very nearly inversely as $(1+ax)^2$. This circumstance led M. Regnault to reject this arrangement for a gas thermometer.

Second Method. In the second method the gas is kept constantly of the same volume, and the elastic force which it presents under different circumstances is measured; then from these by the law of Mariotte, we may calculate the dilatations which the gas would have undergone if the pressure had been kept constant.

The apparatus founded upon this second method are much more easily managed, and give greater precision than those constructed according to the first method: they have moreover the advantage of presenting the same sensibility at high as at low temperatures. By placing in these apparatus air of atmospheric pressure when the reservoir is surrounded by melting ice, we are sure to have instruments rigorously comparable. Nevertheless, if we desire to measure very high temperatures, if for instance the instrument is to be used as an air pyrometer, it is to be feared that the elastic force of the gas within, becoming very considerable, the envelope may experience a permanent change of form under the great interior pressures. This inconvenience may be avoided by introducing into the apparatus, air under an initial pressure less than that of the atmosphere, when the reservoir is at 0°. In this way the elastic force may be kept within limits as low as may be desired, but it is evident that the apparatus becomes less sensitive in proportion as the elastic force of the gas at 0° is feebler; still as the measurement of the elastic force may be made with extreme precision, the indications of the apparatus will be in the greater number of cases sufficiently exact, even though the initial pressure of the gas at 0° was but one-fourth of that of the atmosphere.

But here a very important question presents itself: *are air thermometers filled with air at very different densities comparable with each other?* That is, will such instruments agree at all temperatures when their scales have been made to accord at 0° and 100°? We have before seen (p. 282,) that the absolute value of the coefficient of dilatation of a gas changes very notably with its density; it is required to know whether the changes of density will not produce besides, sensible differences in the law of dilatation. It is absolutely indispensable to decide this question in order to fix the conditions under which air thermometers shall be established in order to be comparable with each other. M. Regnault also proposed for himself a second question which he thinks not less important than the first, viz: *Do gas thermometers, filled with gases of different kinds accord with each other when they have been adjusted at* 0° *and* 100°?

The apparatus used in these investigations consisted essentially of two gas thermometers placed side by side in the same boiler.

Each of these thermometers was composed of a globe of flint glass, (crystal,) of from 700 to 800 cubic centimetres content, terminated by a recurved capillary tube, and a manometric apparatus. The two globes were kept, by copper wires, side by side on a metallic support, consisting of two metallic plates of lozenge form placed one below, the other above the globes, and united by iron rods which were permanently fixed to the cover of the boiler, the upper plate was pierced with two holes through which passed the stems of the air thermome-

ters, and with two other holes, situated in a line at right angles to that joining the first, through which passed the stems of two mercurial thermometers.

The boiler-cover was permanently fixed to a solid partition, and the copper boiler was attached to it by screw bolts, so that it could be removed or replaced without disturbing the thermometers.

The manometric apparatus was composed of two glass tubes of 12 or 14 mm. interior diameter, cemented into an end piece of cast iron provided with a stop cock so arranged, that by properly turning it, you could at pleasure either cause the two tubes to communicate together, or discharge the mercury from either of them, or intercept the communication of the tubes with each other and with the open air. The manometers were fixed to the side of the partition opposite to the boiler.

The capillary tubes of the air reservoir were connected with the capillary tubes of the manometers, by bringing these tubes into exact contact at their ends, and cementing over them a brass tubulure, grooved to fit them outside. This brass tubulure had a rectangular tube opening into it, into which was cemented a capillary tube, by means of which communication was made with an air pump, so as to dry the apparatus and introduce the gases to be operated on.

The boiler contained oil which was constantly agitated so as to maintain an uniform temperature throughout the whole bath.

The method of operating is as follows:

In the first place, to dry the apparatus, a little mercury is put into the inner manometer tube, and the stop-cock so placed as to cut off this tube from communication with the other and with the opening. The lateral tube of the tubulure is then put into communication with an air pump furnished with several tubes filled with pumice soaked in concentrated sulphuric acid, which are intended to absorb the moisture. A vacuum is made a great number of times, and each time the air is allowed to enter very slowly. To be sure that the drying is complete, the globes are heated to 50° or 60° (122° to 140° Fahr.). The pump is then removed but the tubes are left open in communication with the drying tubes. Suppose now that it is desired to compare the movement of a thermometer containing air whose elastic force at 0° is 76 mm., with that of another containing air of a less elastic force.

The two globes are surrounded with melting ice, and the stop-cock of the first manometer being so placed as to make a communication between the two manometer tubes, mercury is poured in so as to raise its level to a mark placed near the top of the inner tube, (that is, the one communicating with the reservoir). The two mercurial columns will be necessarily at the same level because the apparatus communicates freely with the air by the tubulure.

On the other hand a partial vacuum is made in the second globe, and the rarefaction of the air in it is determined by the difference of height of its manometric columns; when a proper rarefaction has been attained, the apparatus is closed by hermetically sealing the lateral capillary tube of the tubulure, and mercury is then poured into the

manometer until its surface stands at a mark made near the top of the inner manometer tube.

The elastic forces are measured by four properly placed cathetometers, each one being so placed as to be able to follow the meniscus in one of the tubes.

The necessary observations of the height of the barometer, and the position of the meniscus of each of the manometer tubes being made, the lateral tube of the first reservoir is then hermetically closed, the ice removed and replaced by oil which is heated by a furnace placed under it. The oil bath is heated until the temperature at which the two instruments are to be compared is attained, the air holes of the furnace are then more or less closed and the oil kept in constant agitation; and the thermometers are adjusted for observation by pouring mercury into the manometer tubes, so as to bring back the level of the columns in the inner tubes to the marks made upon them. The temperature then rising only very slowly, the movements of the four columns of mercury are simultaneously watched, and when they are perfectly stationary, at a signal given by one of the observers the barometer is read, and the temperatures of the air in the vicinity of the manometer tubes, and of the lateral tubes attached to the reservoirs, noted.

As it is essential in this mode of experimenting to keep the temperatures stationary as long as possible, they should be raised very slowly when approaching the maximum at which the observations are to be made, and by a little practice a series of observations may be got at temperatures not differing more than 1° from each other, and the observer be assured that one instrument is not behind the other in its indications. This precaution is above all indispensable when the air thermometer is compared with the mercurial.

It is not necessary, and would be very difficult to bring the mercury in the manometers exactly to the marks. It is sufficient to bring them nearly there, and as the observations give exactly their differences of level, the volumes can easily be calculated when the tubes have been gauged in the vicinity of the marks. The experiments upon thermometers filled with different gases are conducted exactly in the same way.

These globes were too thin to permit the experiments upon thermometers filled with air at a much higher pressure than 76mm. to be tried with them; recourse was had to others similar, but having their walls 3 or 4 mm. thick. These globes were of rather less capacity than the former, holding only about 600 cubic centimetres.

A great number of experiments were made by M. Regnault with the apparatus in which air of ordinary density was compared with that of much less, and with that of much greater density, as well as with hydrogen gas, carbonic and sulphurous acid, and the principal conclusions which he draws from them are as follows:

1. The atmospheric air follows the same law of dilatation from 0° to 350° (32° to 662° Fahr.) of temperature, even when its initial elastic force at 0° varies from $0^{m}\cdot4$ to $1^{m}\cdot3$, (1·33 to 4·25 ft.). So that in the construction of an air thermometer, no attention need be paid to

the density of the air introduced, the instruments will be comparable whatever may be the density.

"2. Atmospheric air, hydrogen gas, and carbonic acid, follow between 0° and 350°, sensibly the same law of dilatation, although their coefficients of dilatation are sensibly different. So that thermometers made with these different gases will accord, provided the temperatures are calculated from their proper coefficients. From this it follows that the coefficients of dilatation of these gases present sensibly the same ratio at every temperature."

"3. Sulphurous acid gas departs notably from the law of dilatation which the preceding gases present. The coefficient of dilatation of sulphurous acid diminishes with the temperature as marked by an air thermometer."

"It is important to remark that in these experiments the relative dilatations of the gases were not measured directly, but were deduced by calculation from the observation of the elastic forces which these gases present at the same temperatures, their volume remaining constant. It appears very probable that similar conclusions would be arrived at, by measuring directly the increase in bulk of the different gases for the same temperatures, their elastic force remaining constant, by a method analogous to that of the fifth series of experiments upon the dilatation of gases; but these experiments would not be susceptible of equal precision in the measurements for reasons already given at the commencement of this memoir, (p. 51.)

(To be Continued.)

List of the Different Processes adopted for the Preservation of Wood, from the year 1657 *to* 1846; *prepared by* M. J. A. Stoeckhardt.

Extracted from "the Artizan;" London, April 1848.

In our October number of last year, we directed the attention of our readers to this subject, than which, it is difficult to conceive one of greater importance in connexion with railway construction. The influences in operation tending to the decay of wooden sleepers, we stated to be as follows:—The solubility of the animal matter they contain—the weak cohesion of their parts—their four-fold composition, as the more numerous the elements in the composition of a body, the more rapid is its tendency to decompose—the oxygen of the air, heat, and humidity—the azotic matter which wood contains, and the attacks of insects, such as ants and teredos. We then stated the most effectual methods hitherto employed for the preservation of wood, together with the cost of the various operations. We now present to our readers a list of the different processes adopted for the preservation of wood, from the year 1657 to 1846, which has been carefully prepared by M. J. A. Stoeckhardt.

No	Date.	Discoverer.	Peparation Employed.	Mode of Application.
1	1657	Glauber	Vegetable tar and pyroligneous acid	The wood having been carbonised by the action of fire, is covered with a coating of tar, and immersed in pyroligneous acid.
2	1740	(?)	. . . . . .	Exposing the wood to the action of vapor.
3	1798	Volmeister	Solution of sea salt	Washing and immersion.
4	1806	Perkins	Ditto	The interstices of the wood filled with dry salt.
5	1815	Bowden	Salt water	Repeated immersion of the wood in the sea.
6	1820	Pasley	Undecomposable liquids, such, for instance, as the acids(?)	The wood is first boiled in water, and then the concentrated liquids applied.
7	1821	Knowles & Davy	Chloride of mercury	Immersion.
8	1821	Dimsdale	Vegetable tar, from which the pyroligneous acid had previously been extracted	Repeated immersions.
9	1822	Prechtl	Vapor of tar	The wood is first exposed to the vapor of water alone, and afterwards to that of a mixture of water and tar.
10	1823	Oxford	Oil of tar, previously treated with gaseous chlorine	Repeated coatings.
11	1824	Cox	Mixture of fish oil, rosin, and sulphur	Saturated by coating the wood and rubbing.
12	1825	Langton	. . . . . .	Extraction by a vacuum, of the air from heated wood.
13	1826	Newmarch	Mixture of linseed oil, sulphate of iron, verdigris, arsenic, and alum	Boiling the wood in the mixture for three hours.
14	1828	Gossier	Saline solutions, forming mutual decompositions, and leaving in the wood an insoluble combination: for instance, *a*, chloride of calcium; *b*, Glauber salt, sulphate of iron, arseniate of soda	Alternate immersions in solutions of the various salts.
15	1829	Carey	Mixture of salt, powdered charcoal, and animal or vegetable oil	The wood having been perforated at different points, the mixture is introduced, and the hole closed.
16	1831	Breant	Oily and resinous matters, or solutions of appropriate salts	The wood is impregnated by pressure in a vertical cylinder, in the natural state, or after having exhausted the air and the sap. The exhaustion is performed by means of another large cylinder communicating with the first, and into which the steam passes, which is condensed by an injection of cold water, and which answers the purpose of an air pump.
17	1832	(?	Smoke	The wood is exposed for a long time to the smoke of green wood, burning slowly.

18	1832	Kyan . .	Solution of chloride of mercury . .	Immersion, and afterwards by pressure.
19	1832	(?) and since Chevalier, 1836.	Tar and decoction of tobacco leaves .	Immersion or coating.
20	1833	(?)	Solution of rosin in fish oil . . .	Coating and repeated rubbing.
21	1833	(?)	Solution of india rubber in fatty oils .	Idem.
22	1834	Strutzke & Society of Arts, Berlin.	Solution of the sulphate of iron . .	Repeated coatings, or introduction of wood with beds or layers of iron pyrites.
23	1835	Monteith .	Lime water	Immersion.
24	1835	(?)	Solution of rosin in oil of turpentine . .	Rubbing with a hot solution.
25	1835	Moll . .	Vapor of eupion and creosote . .	Exposing to the action of the vapor of the eupion and creosote in closed and heated vessel.
26	?	(?)	Concentrated sulphuric acid . . .	Coating to carbonize the surface of the wood.
27	1837	Flockton .	Oil of tar and pyrolignite of iron . .	Immersion.
28	1837	Granville .	Refuse water of salt works . . .	Idem.
29	1837	Letellier .	Chloride of mercury and solution of gelatine	The wood is immersed in a solution of the chlorine, dried, and then coated with a slight layer of glue.
30	1837	Gotthill .	Resinous solutions; as, for instance, tar and oil of turpentine, with the addition of salt	Immersion from one to two hours in a solution heated from 275° to 399° Fah., with or without application of pressure or a vacuum.
31	1837	Margary .	Solution of sulphate or acetate of copper .	The wood first dried is then immersed in the solution.
32	1837	Industrial Society of Annaberg.	Soluble glass and hydrochloric acid .	The wood is immersed for thirty days in the soluble glass, and then placed in water acidulated with hydrochloric acid, washed, dried, and rubbed with oil.
33	1838	Treffy	Salts which mutually decompose each other, as for instance, *a*, chloride of tin or copper; *b*, soda, or lime water	Alternate immersions in the liquids.
34	1838	Burnett .	Chloride of zinc	Immersion of from ten to twenty days.
35	1838	Bethell .	Bituminous liquors, or those which contain creosote; for instance, oil of tar, pyrolignite of iron deprived of ammonia	Extraction of the air, and introduction of the preparations by means of powerful pressure.
36	1839	Boucherie & afterwards Uzielli.	Pyrolignite of iron, pyroligneous acid, muriate of lime, sulphate of copper, chloride of mercury, &c.	The solutions are introduced by the natural absorbing power of the living tree, or incorporated with the wood immediately after it is cut down.

No	Date.	Discoverer.	Preparation Employed.	Mode of Application.
37	1840	Fliselli	Substances which mutually decompose each other; as, for instance, soluble glass, and afterwards dilute sulphuric acid, or solutions, first of alum, and afterwards of potash	The wood is first steamed in a cylinder, the solution of alum or other salt is then introduced and boiled by steam: the alum fixed in the wood is then decomposed by a solution of potash.
38	1840	Münzing	Sulphate of muriate of protoxide of manganese, the refuse liquor of the chlorine works	Immersion in the solution.
39	1841	Pons	Solution of nitrate of iron, saltpetre, alum, and ferrocyanide of potassium	Idem.
40	1841	Payne and afterwards Banner.	Salts which mutually decompose each other; as, for instance, muriate of lime, sulphates of iron and potass, alum and potash	The wood is placed in an iron cylinder, in which a vacuum is produced, and then filled with the first solution, which enters the wood by powerful pressure; this solution is then run out, and the second introduced, when the pressure is again employed; in some cases it will be found necessary to dry the wood either partially or entirely, between the first and second saturations.
41	1842	Timperly	Chloride of mercury	Immersion.
42	1843	Parkes, afterwards Passey, 1845.	Caoutchouc dissolved in carburet of sulphur eupion	Coating or impregnation.
43	1843	Earle	Solution of sulphate of iron or copper	Immersion.
44	1844	Burkes, and after Reichenbach.	Soluble glass and sulphate of iron	The wood is first steamed, then impregnated with solution of sulphate of iron, and lastly with the soluble glass.
45	1845	Ransome, & afterwards Newton.	Solution of silica in caustic soda (soluble glass), afterwards decomposed by an acid	After having expelled the air from the pores of the wood, the solution of soluble glass is introduced by pressure; afterwards place the wood a short time in a diluted acid.
46	1846	Venzat & Banner.	Solution of sulphate or muriate of copper, afterwards decomposed by baryta	Impregnation, as No. 40.
47	1846	Payne	Solutions of metallic sulphurets (lime and baryta), decomposed afterwards by an acid or metallic salt (sulphate of iron, &c.)	Extraction of the air by the vapor of water, and alternate introduction by pressure of the preparations which can decompose each other, as No. 40, so as to leave in the wood a deposit of sulphur or metallic sulphuret, insoluble, and of sulphuret of lime.

On a Formula for the Elastic Force of Vapor at different Temperatures. By Captain Shortrede. *Communicated by Lieut. Col. Sykes, F. R. S.*

The author adopts, as the basis of his formula, the first series of experiments at high temperatures, made by the French Academy, and those of Magnus at low temperatures. For the Academy's experiments, he adopts the indications of the smaller thermometer in the steam, in preference to those of the larger thermometer in the water. Of Dr. Young's sort of formulæ, he notices that of the Academy, and several others, with exponents varying from 5 to 7. From the elasticity at freezing, as given by Magnus, compared with four of the Academy's experiments, he shows that for the range of observation, the number 6 is preferrable to 5 as an exponent; but, as he states, no formula of this sort, with a constant index, can be found to agree with the observations throughout.

The formula of Magnus he finds to agree with these observations better than any of the others; but being adapted to the air-thermometer, and therefore not convenient for ordinary use, he gives his own formula adapted to the mercurial thermometer,

$$t=\frac{500+225\log.A}{5-\log.A},$$

t being the temp. Cent., and A the elasticity in atmospheres of $0^{m}\cdot76$ at zero, or 30 inches at 58° Fah.; ∴ the temperature being given, the formula becomes

$$\log.A=5-\frac{1625}{225+t}.$$

The author compares with the experiments the formula of the Academy, and those of Southern, Coriolis, Tredgold, and one deduced as above; also that given by August, and the same modified, so as to give at freezing the elasticity found by Magnus; also that of Magnus, and the same reduced to the mercurial thermometer, by the data of Dulong and Petit; and lastly, his own formula. Then assuming that the experiment of Magnus are represented by his formula, he compares the other formula with it at every 10° from —10° to 100° Cent. He shows that for the range of their experiments, the Academy's formula is better than the others of Dr. Young's sort; but at low temperatures it is very erroneous. Southern's formula at low temperatures is better than that of Coriolis, but at high temperatures not so good. Tredgold and the other like it, are better at low temperatures than that of Coriolis, but worse at high temperatures. August's formula is very erroneous; and in its modified form it is still worse, the errors increasing to about 10° or more, showing that the theoretic considerations by which it is deduced are not founded in truth. With the Academy's experiments, the errors of Magnus's formula are —, but when reduced to the mercurial thermomoter they are all +, the mean of the whole being $0^{\circ}\cdot33$. With the new formula the errors are nearly balanced, the sums on the thirty experiments being — $1^{\circ}\cdot78$ and + $3^{\circ}\cdot55$, in only two cases

amounting to half a degree. On the twelve experiments, at or near the maximum, the errors are — 1°·12 and + 0°·43.

From zero to 100° the differences between the new formula and that of Magnus are all of one kind; and when reduced to temperature are less than 0°·4, which the author thinks to be within the probable difference between the air and mercurial thermometers, and within the errors of observation.

He then gives a table of temperature, corresponding to elasticity of vapor in atmospheres. Also modifying his formula,

$$\log. f\, 6{\cdot}47712125 - \frac{2925}{373+t},$$

to give f=the elasticity in inches of mercury for temp. Fahr., he gives a table of f for every degree from — 40° to + 360°. by the help of which he compares with his formula, the experiments of Robison, Southern, Dalton, Taylor, Arsberger, Ure, and those of the American Committee, and shows that they differ more widely from each other than from the formula.

Considering the care bestowed to ensure the elasticities being correctly measured, the author is disposed to attribute a great part, if not the whole, of the discordance on the several results, to errors in the measures of temperatures, arising from smallness of scale or incorrectness of division.—*Proceedings of the Royal Society.*

Lond. Edin. & Dub. Phil. Mag.

On the Moist-Bulb Problem. By Captain Shortrede. *Communicated by Lieut. Col. W. H. Sykes, F. R. S.*

The author adopts the notation of Professor Apjohn, and by a similar method deduces the fundamental equation, which is then translated into numbers, taking 1175° F. as the sum of the latent and sensible heats, 0·267 as the specific heat of dry air, the weight of aqueous vapor as five-eighths of that of air, and its specific heat=0·867, that of water being unity.

The coefficient for barometric pressure is resolved into a simple change on the temperature of the air, and consequently also on the depression of the moist bulb; and the equation is put into a shape convenient for use, and shown to be free from objection. The author uses the table of the force of vapor, given in the accompanying preceding paper, and then gives a table of maximum depressions for every degree of the moist bulb, from —40° to 212°, and another table interpolated from it, for every degree of temperature of the air, from 0° to 212°.

Gay-Lussac's depressions are then compared with those of the new formula; and the errors are shown to be almost insensible near the freezing-point, but increasing gradually, till at 25 Cent. it is about 10 per cent. The author attributes these errors to the gradual deterioration of the chloride of lime during the experiments.

The author then compares Prinsep's maximum depressions, collected

and given in vol. v. of the Journal of the Asiatic Society of Bengal. The observed depressions are generally below those given by the new formula, like those of Gay-Lussac. The errors on those where the air was heated by a steam-pipe, are not greater than on those at natural temperatures; and that with air passing through a porcelain tube at an orange heat, falls within the limits assigned by Prinsep in estimating the temperature of the air.

Apjohn's maximum depressions are then compared with the new formula, and here the errors are of an opposite character to those preceding, which the author attributes to the lowering of temperature, occasioned by expansion on escaping from the compression used to force the air in a rapid current through the apparatus. Apjohn's dew-point observations are then compared, and the errors are found to be similar to the preceding, and apparently from the same cause.

To make the formula generally useful, the author gives a table of the depression of dew-point below temperature, for every degree of depression of the moist bulb, at every 5° of temperature from 0° to 100°, and for every 10° from 100° to 140°, which he protracts on a chart, so as to give the dew-point in every case with little more trouble than is required for reading a common thermometer, and also at the same time, the elasticity of vapor in the atmosphere.—*Proceedings of the Royal Society.* Ibid.

Notice of a Theoretical and Practical Treatise on Photography. By Dr. Guillot Saguez.

The object of this essay is to remedy the defects in the different methods already published, which only contain a detail of the manipulations, without in any way touching on theory; which, however, if properly explained, would be the means of enabling the operator to improve, perfect, and modify his plans, and make some progress in the photographic art.

It was in trying to satisfy himself as to some of the chemical phenomena that the author made some essential modifications in an operation already too complicated. Thus, to render paper sensitive to light, he now submits it to one or two operations, of which the first is so simple as to scarcely deserve the name of an operation; and, lastly, to fix the positive drawing or impression, the action of hyposulphite of soda has been studied, step by step; as also the effect of its double decomposition.

The theoretical ideas, which the author has expounded, are not merely speculative, but were suggested by an attentive observation of facts during three years of daily experience. The object of the author will be accomplished, if he succeeds, not in making his own conviction pass into the mind of the reader, but in inducing him to search and publish his own observations. The real progress of photographic science is only to be secured by the publication and general diffusion of the varied experiences of careful operators.

To prepare his negative paper, the author recommends the choice

of a white paper of a perfectly even texture; experience having taught him, that with the same intensity of light, and the same preparation, the rapidity of the formation of the picture was in proportion to the fineness of the paper.

Another advantage obtained by this quality of the paper is, that it does not require to be waxed, an operation which always diminishes the effect of the picture.

The sheet of paper is cut about $\frac{13}{16}$ of an inch longer than the ground-glass of the camera-obscura, and is dipped, for from one to three minutes, in a solution of which the following is a formula :—

Iodide of potassium	5 grammes.
Distilled water	120 "

The paper must then be dried, by suspending it in the air for about twelve hours, when it will assume a rosy hue; this preparation may be made in broad daylight, and will keep several months, provided it is preserved from damp.

When a photographic picture is to be taken, a small quantity of the following liquid is to be poured on a piece of plate-glass, reserved expressly for this purpose, sufficient to slightly moisten the surface of the paper:—

Nitrate of silver	5 grammes.
Acetic acid	10 "
Distilled water	60 "

The action of the azotate of silver in contact with iodide of potassium forms an iodide of silver, white, solid, and easily decomposed by the action of light. The author is very particular about the proportions of the iodine and the silver. If the quantities were equal, the iodide of silver would be little or not at all sensible to light. But if, as he shews, the silver is 1, and the iodine only 0·5, the salt produced will be highly sensitive to the action of light.

For a description of the means employed to bring out and fix the negative image or picture, the reader is referred to the treatise itself. If, however, the processes there given do not differ materially from those already known, the author has so blended theory and practice as to thoroughly explain the action of each substance, and the preference given to the manipulations he mentions.

Preparation of Positive Paper.

A sheet of paper, cut to about the same size as the negative sheet, is laid for a few seconds on the surface of the following solution :—

Chloride of sodium	1 gr. 25
Distilled water	30 "

When the paper is well saturated, it is dried between blotting-paper; and that side of the paper which was in contact with the above-mentioned solution is now laid on the surface of a solution thus composed :—

Azotate of silver	5 grammes.
Distilled water	30 "

It is left on this liquid for some time; after which, it is suspended and dried in a dark room. When quite dry, it can be used, even twenty-four hours after its preparation. However carefully it may have been kept from the sun's rays, it will nevertheless assume a faint rosy tint; so that the lights in the picture will not be equal in brilliancy to the ordinary unprepared paper; for this reason, it is advisable to prepare only as many sheets as are required for the day's use.

Lastly,—follow the details for producing the positive picture, and for fixing it in a solution of

Hyposulphite of soda	5 grammes.
Distilled water	300 "

This salt has a very evident action on chloride of silver, which it dissolves by the prolongation of its action. The hyposulphite of soda is decomposed, and forms sulphuret of silver insensible to light. The fire to which it is necessary to expose each positive picture, to bring it out more clearly, aids this decomposition of the hyposulphite.

A daily experience of some years has proved to the author the advantage of exposing photographic pictures to the fire; and at the same time it has confirmed his opinion of the necessity for combining theory and practice in order to advance the science of photography.

Comptes Rendus. **Lond. Journ. Arts & Sci.**

On Screw Propellers.

Mr. Cowper commenced by an illustration of the law of resistance to a body moving through water. A disk of tin was drawn up from the bottom of a jar of water by one weight hung over a pulley—the time being measured by 20 beats of a pendulum. It was then drawn up in 10 beats (*i. e. twice* the velocity) by *four* weights,—showing the resistance to be as the square of the velocity. The disadvantages of the common paddle-wheel were pointed out, and the various contrivances to obviate them, in the inventions of Buchanan, Oldham, Morgan, Field, Galloway, &c. A general index was given of the various screw propellers of—

Paucton . . .	in 1768	Woodcroft . .	in 1832
Bramah . . .	1795	Smith . . .	1836
Shorter . . .	1802	Ericsson . . .	1836
Fulton . . .	1802	Lowe . . .	1838
Trevithick . . .	1815	Blaxland . . .	1841
Cummerow . .	1828	Buchanan . . .	1841

The general principles of the propeller, and the effect of a variety of forms, were illustrated by causing the propellers to travel along a horizontal wire (about 8 feet long) by giving them a rapid rotation. Woodcroft's propeller was explained. It consists in making the screw with an *increasing pitch,*—the term pitch meaning the distance between the threads of the screw. A screw of uniform pitch is an inclined *plane* wrapped round a cylinder. A screw of increasing pitch is an inclined *curve* wrapped round a cylinder. If the blades of the

propeller are bent so as to be somewhat hollow, this would make an increasing pitch. The experiments proved that a small portion of a blade of uniform pitch did the duty,—the rest of the blade merely following in the wake of the effective portion; but by making the blade with an increasing pitch, each increasing portion overtakes the disturbed water, and so becomes effective. Accordingly, the model, with Woodcroft's increasing pitch, flew along the wire rapidly; but when it was reversed, it would scarcely move. On a large ship a similar experiment was tried,—making a difference of 20 per cent. when the screw was reversed. The Great Britain was fitted with Woodcroft's screw on her last voyage, and there is little doubt propelled the vessel *faster* than the captain was aware. A large diagram was shown (the full size) of the screw fitted to the Blenheim (74), the Oak, and the Termagant (22 guns). The screw consists of two blades. It is 16½ feet in diameter; the blade is 7 feet wide, and the twist or angle of the blade is such that when lying on the ground the upper edge would be 3 feet 4 inches high. The screw is let down through a water-tight well at the stern of the vessel, and can be drawn up out of the water so as to give no impediment when the ship is sailing with a fair wind; and yet the weight of the screw is 6½ tons, and the short iron shaft fixed in its centre 1½ ton,—making together 8 tons. The screw is of gun metal, and worth about £650. H. M. yacht Fairy was fitted with a screw propeller of two blades, 5 feet 4 inches in diameter. She has two engines of 64-horse power each, and her speed is 15⅓ miles per hour. The Sarah Sands (1300 tons) is one of the best examples of auxiliary steam power. She has two oscillating engines of 180-horse power, driving (by direct action) a Woodcroft screw of four blades and 14 feet diameter. She made the passage to New York in twenty days; while the sailing packets took forty, and has just returned from New York in *fourteen days*, and has frequently made eleven miles in the hour. After the lecture, Mr. Cowper explained the various engines used for driving the screw, and exhibited a large model of improved gearing for those cases in which toothed wheels were employed. The "wave-line" form of vessel recommended by Mr. Scott Russell was also demonstrated by experiment. Lon. Athenæum.

Schafhaeutl's Powder, for rendering Iron malleable, and cleaning it from Sulphur, Phosphorus, and Arsenic.

Schafhaeutl's method of rendering iron malleable, and cleaning it from sulphur, phosphorus, and arsenic, in some parts of Germany, has been employed with tolerable success, and produced favorable results. The method in itself is simple, and the theory appears to be more practical than such experiments in general prove. This powder consists of 1¾ lb. of the peroxide of manganese, 3¾ lbs. of common salt, and 10 ozs. of potter's clay—the clay and the common salt are the most important elements. By the heat of the puddle oven, the salt mixed with the clay is decomposed. The natrium, either on account of the air, or the peroxide of manganese, attaches itself to the oxygen, and changes to natron, which, with the argillaceous and quart-

zose earth, forms itself into a silicate, or aluminate, of natron, and goes in the slag. The peroxide of manganese loses a great quantity of its oxygen, and forms itself as oxide of manganese with the silicious earth (from the silicum of the pig-iron) to a silicate, and prevents the loss of the metal. This free chlorine, which, with constant stirring, is brought to bear on the mass, attaches itself to the sulphur, phosphorus, or arsenic, and makes combinations, which are carried out of the furnace through the grate. From this it will be seen, that this method not only cleanses the iron, but shortens considerably the process of rendering it malleable. The quantity of peroxide of manganese can be considerably diminished when it is worked in open hearths, as in some places in Germany. It was endeavored to introduce this method in iron smelting by cupola furnaces, but, on account of various reasons, it could not be carried into execution. It was proposed to employ sal-ammoniac instead of salt; the chlorine in sal-ammoniac is double the quantity of that contained in an equal weight of salt. No clay is required, it does not increase the slags, and the quantity of hydrogen gas in sal-ammoniac (7 or 8 per cent.) contributes much to the cleansing of the iron. The expensive cost of the sal-ammoniac has prevented its employment on a large scale. **London Mining Journal.**

Analysis of Moulding Sand.

A correspondent of the *Mining Journal* forwards the results of four analyses of moulding sand, by Herr Kaupmann, of the laboratory of the Royal Institution at Berlin, from which it appears that, in widely different localities, the best article is remarkably alike in composition, and that it may be artificially produced, by mixing about 93 parts of silicious earth, or quartzose sand, with 2 parts of oxide of iron, and 5 of clayey or argillaceous earth, as free as possible from lime. These proportions he particularly recommends for the casting of statues, &c. **London Builder.**

Experiments to ascertain whether the mixture of Zinc with Iron in its manufacture, is injurious to the Iron or otherwise. By James Nasmyth.

Sir,—Under the impression that it may be interesting to some of your readers, I send you the results of an investigation which has been lately made, at the desire of the Lords of the Admiralty, by their "Committee on Metals," for the purpose of ascertaining whether the adoption of the process of galvanizing wrought-iron, by chemical coating of metallic zinc, had any prejudicial effect in preventing such galvanized articles from being re-manufactured, in the event of such becoming obsolete, as in the case of working up old or scrap iron. With a view to put this question to the test of experiment in the most severe manner, a piece of *galvanized iron wire rope* was welded up into a bar, and put to the most severe test. In the first place it was found, that although the iron-wire was quite covered with metallic

zinc, which, although partially driven off in the process of welding, yet, so far from the presence of the metal, or its oxide, presenting any impediment to the welding of the iron, (as in the case of lead,) the iron-wire welded with remarkable ease; and the result was, a bar of remarkably tough, silvery-grained iron, which stood punching, splitting, twisting, and bending, in a manner such as to show, that the iron was not only excellent, but to all appearance, actually improved in quality in a very important degree.

Encouraged by such a result, a still further, and even more severe, trial was made—viz.: by welding up a pile of clippings of galvanised iron-plates, or sheet-iron, covered with zinc, as in the former experiments. The presence of the zinc appeared to offer no impediment to the welding, and the result was, a bloom or bar of iron—the fracture of which presented a most remarkable and beautiful silvery grain—as good, if not superior, in aspect, to the very finest samples of "Low Moor" or "Bowling" iron. Blooms of this iron were rolled out into rods, and tested in the cable-proving machine, and the result indicated from 5, to 10 per cent. higher strength than the best samples of wrought-iron—thus establishing the fact, that so far from the presence of zinc being destructive to the strength and tenacity of wrought-iron, the contrary is the case.

I may mention, that bars of iron were heated to a welding heat, prepared by Scarf for sheathing, in the usual manner; and, on drawing them from the fire, for being welded, a handful of zinc filings was thrown on the welding hot surface, and the welding proceeded with; in this severe test no apparent impediment to the process resulted; the iron welded as well as if no zinc had been present. Judging from the appearance of the iron welded up from "zinc covered iron scraps," not only as respects its clear silvery aspect, but also the increased strength, which such exhibited under proof, it may not be unreasonable to infer, that some important improvement might be made in the manufacture of iron by the actual introduction of metallic zinc in some one or other of the stages of its manufacture—such as in the puddling-furnace. What the nature of the action of the zinc is, we are not yet able to say; all we as yet know is, that, so far from being prejudicial to the quality of the iron, it appears to have rather an improving effect; and that to such an extent as to cause us to desire that the subject may receive the attention of some of our intelligent iron manufacturers, so as to put the matter to the test of actual experiment in the puddling-furnace, or any other stage of the process, such as may appear to promise the best results. This, however, can only be viewed as a suggestion; but it appears to me to be a subject well worthy of attention—and for that reason alone I have taken the liberty to lay the matter before your readers; for, as being the result of the experiments conducted for the public good, the public are entitled to the result.

I may name a curious corroborative fact, that the strongest cast-iron made in Belgium, and selected for the casting of guns, is made from an iron ore, in which the *ore of zinc* forms a considerable portion. Whether the superiority of this iron is due to the presence of zinc, is

a question; but the result of the before-named experiments tend to lead to the supposition, that such may be the case.

Bridgewater Foundry, Patricroft, near Manchester, May 10.

Lond. Min. Journ.

Paper-hangings prepared by means of Nitrate of Silver and other Salts.

M. Larocque presented a paper to the *Academie des Sciences*, Paris, explaining a new process for coloring and designing paper-hangings. He observès, that nearly all the salts are volatilized under the influence of vapor from water or saline solutions, and that the nitrate of silver, among other salts, on account of its easy reduction, would furnish a great variety of shades of color; and by means of reserves made in the paper, any designs in white might be obtained. The following is the process employed:—Take of pure nitric acid, sp. gr. 1·50, two parts; and distilled water, one part. Place the mixture in a porcelain capsule and heat it, throw in about two ounces of silver, and continue to apply heat until the action of the acid on the metal has ceased; with this quantity of silver 700 or 800 sheets of paper may be colored. In this operation but a very small loss of silver will be found, for the residue can be formed into nitrate of silver and sold; or, if calcined at a red heat in a crucible with carbonate of soda, the metallic silver may be obtained and employed for a new operation. In order to obtain good designs, it is necessary to operate in a place well lighted and out of currents of air. Civ. Eng. & Arch. Journ.

Improvement in the Safety Lamp.

At a recent meeting of the Geological and Polytechnic Society of the West Riding of Yorkshire, the Rev. W. Thorp produced a new lamp which will remedy all the defects in the lamp of Sir H. Davy; affording five times more light, and being, it is said, safe in every condition of the coal mine. In order to obtain more light, the Rev. W. Thorp introduces the solar burner, characterized by the circular wick, and the air admitted through its centre from the bottom of the lamp, protected of course by gauzes of wire. Connected with this part is an adjustment, placed outside of the cistern, by which the wick can be raised or lowered. Over the light is applied a chimney of iron, based with a few inches of glass, with air admitted to supply the exterior of the flame from the inside of the lamp. This is so fixed that it cannot be broken from the ordinary falls to which these lamps are liable to be exposed. Having obtained a much higher illuminating power than that generally used by miners, the next object being to ensure perfect safety in every condition of the mine, there are inserted into the chimney four or five chambers of wire gauze, so that the flame of ignited gas has to traverse eight or ten meshes before it can possibly reach the exterior fire-damp; but as one mesh, as in the old lamp, is safe unless exposed to a current, and as no lateral current of gas or air can be exerted upon the flame on account of the chimney

the lamp is perfectly safe. And it is found, by any artificial means, utterly impossible to pass flame through these chambers of gauze, so that it appears to be quite safe under every circumstance and condition of the mine. There are other advantages over the Davy lamp of no inconsiderable value:—1. It requires trimming only once a week; 2. The oil does not fall out if laid on one side; 3. It is much more easily cleaned; 4. The cheapest oil can be used in it. As no patent will be taken out for the new lamp, and the whole of the improvement is generously given to those interested in collieries, the Rev. W. Thorp expresses an earnest wish that all lamps may be purchased of Mr. W. Ramsden, of Wakefield, through whose assistance he has been enabled to produce the lamp. **London Athenæum.**

Copper-wire Cord for Window-Sash-Lines, &c.

Messrs. Newall & Co. have greatly improved their patent copper wire cord, which is now made extremely flexible, and is well adapted for window-sash-line, hot-houses, lightning conductors, picture-cord, clock-cord, bell-hanging, and many other purposes for which hempen rope has hitherto been used; the advantages being that it is cheaper, much more durable, and one-sixth part the bulk of hempen rope.

Civ. Eng. & Arch. Journ.

BIBLIOGRAPHICAL NOTICES.

Statistics of Coal, &c., &c. Prepared by RICHARD COWLING TAYLOR. *Philadelphia: J. W. Moore,* 1848.

Mr. Taylor, the author of this book, has long been known as a most assiduous and pains-taking geologist, to whose laborious and minutely accurate investigations we owe much of our knowledge, especially of our Pennsylvania coal fields. His unpretending modesty, and readiness to yield to others, has prevented his name from being as well known to the public as those of others, but we doubt, whether, in the whole list of those who have devoted themselves to American Geology, there is one of more solid acquirement, and more profound judgment a more accurate observer, or more indefatigable laborer, than Mr. Taylor. As President of the Dauphin Coal Company, it was his duty to watch the progress of mining industry, and we knew that he was in possession of a great mass of statistical facts upon this subject.—When, therefore, it was first announced that he was about to publish a work upon this subject, our expectations were highly excited, and we should have been deeply disappointed, if we had found the proposed volume of only moderate value; yet we confess that we were in no wise prepared for such an extensive and elaborate digest of important information, as that which he has presented. We would scarcely have thought it possible, that one individual, especially in this country, where the facilities for such a purpose are so few, and with

other and laborious duties daily pressing upon him, should have collected together such a mass of facts, and made of them so well arranged, and so delightful a book. And now that, for about the twentieth time, we take it up to look over its contents, and read an occasional chapter, our astonishment is in no degree abated at the extent and variety of the information which it affords; for this work is by no means confined to the development of mere tabular statements of the production of this important fuel, in various countries, but embraces within it every kind of information which those interested in this subject would be likely to seek. The geology of coal fields—the various fossils which characterize them—the mode of sinking, and of working the mines—the precautions taken to secure the health and lives of the miners; in short, every matter which is of importance to those engaged in mining projects, or interesting to the general reader, are here considered. Nor is it confined to the study of coal only, but embraces all those fossil productions which bear an analogy to it—brown coal, peat, bitumen—and even the statistics of wood, as a fuel, have a place in its pages; and the reader will find, moreover, much valuable information on the subject of the manufacture of iron, a subject which the author justly observes, is "so interwoven with matters essential to our main subject, that a considerable mass of information has been necessarily incorporated in our pages."

The method in which these various subjects are treated, is worthy of their extent and importance. The style is perfectly plain and unpretending. Great care has evidently been taken to acknowledge the labors of those from whom the information was obtained. The work is properly and judiciously illustrated by maps and diagrams, and we especially recommend to the notice of our readers, the ingenious and striking method of presenting comparative results, by proportional square areas.

We cannot do more than notice this book at present. We hope, when we have had time to give it the study which it deserves, to recall the attention of the public to it, in a more extended review, and we shall, by the permission of the author and publisher, treat our readers, from time to time, with some of its valuable information.

We take our leave of it, for the present, with the sincere hope, that its publication may prove as profitable to the author, as it undoubtedly will be to the public. F.

We have received a note from Prof. W. R. Johnson, the American editor of Knapp's Chemical Technology, requesting us to republish the article upon the cost of manufacturing illuminating gas, in our Journal, in order that our readers may certainly know how far our criticisms upon Prof. J. are well founded. We have given already the reasons why we do not believe our Journal to be the proper vehicle, either for personal accusations against the persons in charge of the Philadelphia Gas Works, or for their defence against such accusa-

tions; we must, therefore decline acceding to Prof. Johnson's request. We have already said that, as the citizens of Philadelphia are those who are most interested in the truth or falsehood of these charges, the most of which have no scientific bearing whatever, it is in the daily press of our city that the discussion ought to be carried on, and if the charges find their way into the newspapers, the friends of the parties concerned will, we have no doubt, reply, and the truth will be developed. But the questions, whether the Superintendent of the Philadelphia Gas Works has, or has not, "a direct or indirect interest in keeping up the price of gas;" or if he has such, whether it influences him against the adoption of proper improvements; and whether he does, or does not, "surround the subject of gas making with mystery," and other questions of this nature, we again most respectfully suggest to Prof. Johnson, have no appropriate place in our Journal, nor do we think they have in his edition of Knapp's Chemical Technology.

Com. Pub.

FRANKLIN INSTITUTE.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on A. G. Heckrotte's *Self-Acting Safety Coupling for Rail road Cars.*

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination the self-acting safety coupling for railroad cars, invented by A. G. Heckrotte, Washington city, D. C.,

Report—

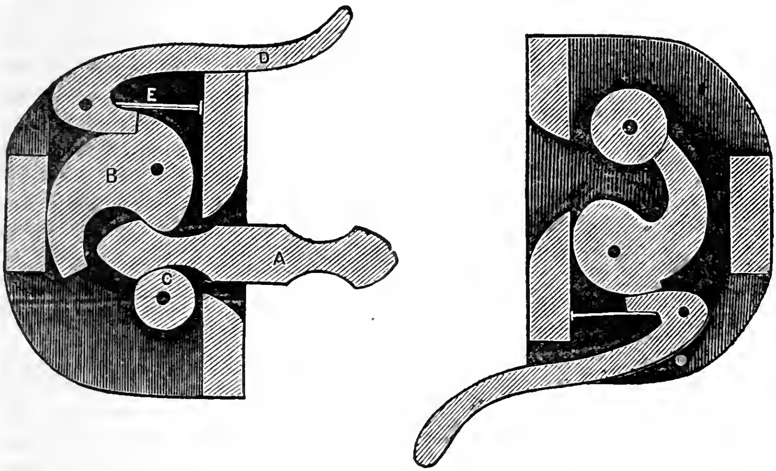
The apparatus consists of a flat box, figs. 1 and 2, containing the necessary arrangements for securing the head of the coupling bar A, which is received in an opening by guides which are constructed with a sufficient flare to allow of its entrance at any angle at which it would be likely to be presented. The bar on its entrance, finds itself opposed by a disk or friction roller. C, on one side and a tumbler, B, of peculiar shape on the other; a slight revolution of each of these allows the head of the bar to pass, until, in revolving, a notch on the tumbler is caught by a trigger, D, arranged for the purpose, and which prevents the bar, when acted upon by traction, from being drawn from the box. The trigger is allowed to extend beyond the box and front of the car, so that, when the train is brought into such a position as to endanger the passage of a car by being thrown too obliquely one to another, the trigger is acted upon by the front of the car preceding and the coupling is immediately disengaged.

The arrangement of the apparatus is such that the cars are coupled instantly by merely running them together, and the fastening is completed without any farther intervention; in this the chief merit of the invention consists; it also has the important advantage of permitting

the cars to be uncoupled at will, even when all the couplings are tightly strained, which cannot be done by the usual arrangement.

The committee are convinced of the great utility of Mr. Heckrotte's invention in the coupling and uncoupling of cars in a neat and effective manner, with much less danger to life and limb than the ordinary method.

The statistics in possession of the committee are not sufficient to assure them that the immediate uncoupling of cars in motion is more likely to prevent accidents than the retaining them together; there are facts enough, however, in which the lives of passengers have been saved by the continuity of the train being preserved, to warrant a doubt as to this question.



Mr. Heckrotte has a very ingenious and neat method of constructing the tumbler, the shape of which requires great nicety in its formation; a plan of this is shown in the drawing accompanying the report.

By order of the Committee,

William Hamilton, *Actuary.*

June 8th, 1848.

Report on Mr. S. Colton's *Improved Door and Pad-locks.*

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination an improvement in Door and Pad-locks, invented by Sabin Colton, of the City of Philadelphia, Pennsylvania,

Report—

That the peculiarity of Mr. Colton's locks is this:—Three circular metal disks are placed in a frame having three grooves cut in it of the proper size, in which the disks turn freely and independently on the same axis. This frame carries the detent or catch

which holds the bow in the case of the padlock, and is thrust back by means of a spring when unlocked. The circular disks project above the frame which carries them, and in one position, the projecting parts are cut down even with the frame, so as to allow it to move backwards and forwards freely in the lock. Each disk has a hole or slot drilled into it, to which a projecting point from the key fits, and it is so constructed that when the key is turned in a given direction, the disks can be brought to the position where they do not project above the frame; but if it is turned in the contrary direction, they can never be brought to this position, owing to the manner in which the slots are cut in the disks. On the inner side of one of the faces of the padlock, three grooves are cut, into which the disks will fit. When the frame is thrust forward by pressing on the key, the detent which it carries is forced into the catch in the bow of the padlock, and in this position the grooves on the face of the padlock are immediately over and in the same line as the disks, and by turning the key the latter will enter them, and the lock is then fastened. Now turning the key in the opposite direction, the disks cannot be brought to the position where they all shall be out of the grooves on the face of the padlock. And when the motion of the key has been reversed in this manner, it is impossible to make a key from an impression of the wards, taken in this position. And as there is no rule for making the key, and no two are made alike, a key will only open the particular lock for which it is made. Thus rendering it a matter of extreme difficulty to pick the lock. The same contrivance is applied to door and fire proof locks. The frame into which the disks are inserted is caused to slide down (by pressing on the key) behind the bolt, and thus prevents it from being pushed back, and when in this position, the disks are turned by the key into the grooves cut for them. When by turning the key in the proper direction the disks are brought out of the grooves, the frame is caused to fly up by means of springs, and the bolt may be pushed back, and the door unlocked. The bolt is moved backwards and forwards by means of a handle like the ordinary locks of doors. And this is a great advantage in Mr. Colton's lock, that the sliding of the bolt is independent of the arrangement for locking it, thus diminishing the size and friction of the parts which the key has to turn, and allowing the key to be made of a small and convenient size. The keys of Mr. Colton's fire proof locks are very little larger than the ordinary brass dead-latch key. From the form of the wards and the key hole it is not an easy matter to blow the lock to pieces by gunpowder, as the charge would be blown out of the key hole before it would break the lock.

The Committee have only further to remark that Mr. Colton's locks are characterized by simplicity of arrangement and construction, and are not liable to get out of repair. They are a useful invention and an improvement over the ordinary form of locks, attaining all the advantages of the most complicated construction.

By order of the Committee,

William Hamilton, *Actuary.*

June 8th, 1848.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1848.

CIVIL ENGINEERING.

The General Railroad Law of the State of New York.

An Act to authorize the formation of Railroad Corporations. [Passed March 27, 1848.]

(Continued from page 13.)

Sec. 21. In case any married woman, infant, idiot or insane person, or any unknown owner, or owners not personally notified to appear, and who shall not appear after such notice on the appointment of commissioners, shall be interested in any such lands, real estate and property, the court shall appoint some proper person to appear before the said commissioners and act as attorney for and in behalf of such married woman, infant, idiot, insane person, unknown owner or non-appearing owner, not personally served with notice.

Sec. 22. If at any time after the location of the track of said road, in whole or in part, and the filing of the map thereof, it shall appear to the directors of the said company, that the line in some parts thereof may be improved, it shall be lawful for the said directors from time to time to alter the line, and cause a new map to be filed in the office where the map shewing the first location is or shall be filed, and may thereupon proceed to take possession of the lands embraced in such new location, that may be required for the construction and maintenance of said road on such new line, and the convenient accommodations appertaining to the same, and acquire the same either by agreement with the owner or owners, or by such proceedings, as near as may be, as are authorised under the preceding sections of this act, and use the same in place of the line for which the new line is substituted.

Sec. 23. Whenever the track of said railroad shall cross a railroad

or highway, such railroad or highway may be carried under or over the track, as may be found most expedient, and in cases where an embankment or cutting shall make a change in the line of such railroad or highway desirable, with a view to a more easy ascent or descent, the said company may take such additional lands for the construction of such road or highway on such new line, as may be deemed requisite by said directors. Unless the lands so taken shall be purchased or voluntarily given for the purposes aforesaid, compensation therefor shall be ascertained in the manner in this act provided, as nearly as may be, and duly made by the said corporation to the owners and persons interested in such lands, the same, when so taken on compensation made, to become part of such intersecting railroad or highway, in such manner and by such tenure as the adjacent parts of the same highway may be held for highway purposes.

Sec. 24. If any such corporation shall, for its purposes aforesaid, require any land belonging to the people of this state, or to any of the counties or towns, the commissioners of the land office, and county and town officers respectively having charge of such land, may grant such lands to such corporation, for a compensation which shall be agreed upon between them, and if they shall not agree upon a sale and price, the same may be taken by the corporation as is before provided in respect to other cases.

Sec. 25. If the transportation of property on the railroad of any company formed under this act, running parallel or nearly parallel to any canal of the state, and within thirty miles of said canal, other than ordinary baggage of passengers transported thereon, shall in the opinion of the legislature, divert business of transporting property from any of the canals belonging to this state, the company owning such railroad shall pay to the canal fund, on all property transported upon its railroad other than the ordinary baggage of passengers transported thereon, the same tolls that would have been payable to the state, if such property other than such baggage, had been transported on any of such canals. And every such company shall make returns, at such time and in such manner as the commissioners of the canal fund shall prescribe, of all the property transported on its railroad, except the ordinary baggage of passengers transported on the same. And the said commissioners are hereby authorized and required to prescribe the manner in which such tolls so payable to the canal fund by such company, shall be collected and paid, and to enforce the collection and payment thereof, and to make such regulations as they shall deem proper for that purpose; and every such company that shall neglect or refuse to comply with any such regulation shall forfeit to the people of this state the sum of five hundred dollars for every day it shall so neglect or refuse; and in every case of such forfeiture it shall be the duty of the attorney general to prosecute such company for the penalty, in the name of the people.

Sec. 26. If the legislature of this state shall, after the expiration of ten, and within fifteen years from the completion of any such road, make provision by law for the re-payment to any such company of amount expended by them in the construction of the said road, to-

gether with all monies for permanent fixtures and the actual value of the cars, engines, machinery and chattels, and real property then in use for the said road, with interest on such sums at the rate of ten per cent. per annum, together with all monies expended by said company for repairs or otherwise, for the purposes of said road, after deducting the amount of toll, freight, and passage money received on said road, then the said road with all its fixtures and appurtenances aforesaid shall vest in and become the property of the people of this state.

Sec. 27. Every conductor, baggage master, engineer, brakeman, or other servant of any such railroad corporation employed in a passenger train, or at stations for passengers, shall wear upon his hat or cap, a badge, which shall indicate his office, and the initial letters of the style of the corporation by which he is employed. No conductor or collector without such badge, shall demand, or be entitled to receive from any passenger, any fare, toll or ticket, or exercise any of the powers of his office, and no other of the said officers or servants without such badge, shall have any authority to meddle or interfere with any passenger, his baggage or property.

Sec. 28. Every such corporation shall make an annual report to the state engineer and surveyor, of the operations of the year, ending on the first day of January, which report shall be verified by the oaths of the treasurer, and acting superintendent of operation, and filed in his office by the twentieth day of January in each year, and shall state:

1. The capital stock and the amount actually paid in.

2. The amount expended for the purchase of land, for the construction of the road, for buildings, and for engines and cars, respectively.

3. The amount and nature of its indebtedness and the amount due the corporation.

4. The amount received for the transportation of passengers, of property, of the mails, and from all other sources.

5. The amount of freight, specifying the quantity in tons, of the products of the forest, of animals, of vegetable food, other agricultural products, manufactures, merchandize, and other articles.

6. The amount paid out for repairs, engines, cars, building, and salaries.

7. The number and amount of dividends, and when paid.

8. The number of engine houses and shops; of engines and cars, and their character.

9. The number of miles run by passenger, freight, and other trains respectively.

10. The number of men employed, and their occupation.

11. The number of persons injured in life or limb, and the cause of such injuries.

12. Whether any accidents have arisen from carelessness or negligence of any person in the employment of the corporation, and whether such person is retained in the service of the corporation.

Sec. 29. Any such corporation which shall neglect to make such report, shall be liable to a penalty of two hundred and fifty dollars, to be sued for in the name of the people, for their use.

Sec. 30. The legislature may, when any such railroad shall be open-

ed for use, from time to time alter or reduce the rates of toll, freight, fare, or other profits upon such road; but the same shall not, without the consent of the corporation, be so reduced, as to produce with said profits less than ten per centum per annum, on the capital actually paid in: nor unless on an examination of the amounts received and expended, to be made by the state engineer and surveyor and the comptroller, they shall ascertain the net income derived by the company from all sources for the year then last past, shall have exceeded an annual income of ten per cent. upon the capital of the corporation actually paid in.

Sec. 31. Any such corporations shall, when applied to by the post-master-general, convey the mail of the United States on their road or roads respectively; and in case such corporation shall not agree as to the rate of transportation therefor, and as to the time, rate of speed, manner, and condition of carrying the same, it shall be lawful for the Governor of this State, to appoint three commissioners, who, or a majority of whom, after fifteen days' notice in writing of the time and place of the meeting to the corporation, shall determine and fix the prices, terms, and conditions aforesaid: but such price shall not be less for carrying said mails in the regular passenger trains than the amount which such corporation would receive as freight on a like weight of merchandize transported in their merchandize trains, and a fair compensation for the post office car. And in case the post-master-general shall require the mail to be carried at other hours or at a higher speed than the passenger trains be run at, the corporation shall furnish an extra train for the mail, and be allowed an extra compensation for the expenses and wear and tear thereof, and for the service to be fixed as aforesaid.

Sec. 32. If any passenger shall refuse to pay his fare, or toll, it shall be lawful for the conductor of the train and the servants of the corporation to put him out of the cars at any usual stopping place the conductor shall elect.

Sec. 33. Every such corporation shall start and run their cars for the transportation of passengers and property at regular times to be fixed by public notice, and shall furnish sufficient accommodations for the transportation of all such passengers and property, as shall within a reasonable time previous thereto, offer or be offered for transportation, at the place of starting and the junctions of other railroads, and at sidings and stopping places, established for receiving and discharging way passengers and freight; and shall take, transport, and discharge such passengers and property at, from, and to such places, on the due payment of the toils, freight, or fare legally authorized therefor.

Sec. 34. In case of refusal by such corporation or their agents so to take and transport any passenger or property, or to deliver the same or either of them at the regular or appointed time, such corporation shall pay to the party aggrieved, all damages which shall be sustained thereby with the costs of suit.

Sec. 35. A check shall be affixed to every package or parcel of baggage, when taken for transportation by the agent or servant of such

corporation, and a duplicate thereof given to the passenger or person delivering the same on his behalf. And if such check be refused on demand, the corporation shall pay to such passenger the sum of ten dollars to be recovered in any action of debt, and further no fare or toll shall be collected or received from such passenger, and if such passenger shall have paid his or her said fare, the same shall be refunded by the conductor in charge of the train; and on producing said check, if his or her baggage shall not be delivered to him or her, he or she may himself or herself be a witness in any suit brought by him or her to prove the contents and value of said baggage.

Sec. 36. In forming a passenger train, baggage, or freight, or merchandize or lumber cars, shall not be placed in rear of passenger cars; and if they, or any of them shall be so placed, and any accident shall happen to life or limb, the officer or agent who so directed, or knowingly suffered such arrangement, and the conductor and engineer of the train, shall each and all be held guilty of intentionally causing the injury, and be punished accordingly.

Sec. 37. A bell of at least thirty pounds weight shall be placed on each locomotive engine, and be rung at the distance of at least eighty rods from the place where the railroad shall cross any road or street, and be kept ringing until it shall have crossed such road or street: under a penalty of fifty dollars for every neglect, to be paid by the corporation owning the railroad, one half thereof to go to the informer and the other half to the state, and also be liable for all damages which shall be sustained by any person, by reason of such neglect.

Sec. 38. Every such corporation shall cause boards to be placed, well supported by posts or otherwise, and constantly maintained across each public road or street where the same is crossed by the railroad on the same level; said boards shall be elevated so as not to obstruct the travel, and to be easily seen by travelers; and on each side of such boards, shall be painted in capital letters of at least the size of nine inches each, the words "railroad crossing, look out for the cars while the bell rings;" but this section shall not apply to streets in cities or villages, unless the corporation be required to put up such boards by the officers having charge of such streets.

Sec. 39. If any person shall, while in charge of a locomotive engine running upon the railroad of any such corporation, or while acting as the conductor of a car or train of cars on any such railroad, be intoxicated, he shall be deemed guilty of a misdemeanor.

Sec. 40. If any person shall wilfully do, or cause to be done, any act or acts whatever, whereby any building, construction, or work of any such corporation, or any engine, machine, or structure, or any matter or thing appertaining to the same, shall be stopped, obstructed, impaired, weakened, injured, or destroyed, the person or persons so offending shall be guilty of a misdemeanor, and shall forfeit and pay to the said corporation, treble the amount of damages sustained by means of such offence.

Sec. 41. All penalties imposed by this act, except the penalty imposed by the twenty-fifth section thereof, may be sued for by any district attorney, and in the name of the people of the State of New York,

and if such penalty be for a sum not exceeding one hundred dollars, then such suit may be brought before a justice of the peace.

Sec. 42. Such corporation shall erect and maintain fences on the sides of the road, of the height and strength of a division fence as required by law, with openings and gates therein, and farm crossings of the road for the use of the proprietors of lands adjoining such railroad, and also construct and maintain cattle guards at all road crossings, suitable and sufficient to prevent cattle and animals from getting on the railroad. Until such fences and cattle guards shall be duly made, the corporation and its agents shall be liable for all damages which shall be done by their agents or engines to cattle, horses, or other animals thereon, and after such fences and guard shall be duly made, the corporation shall not be liable for any such damages, unless negligently or wilfully done, and if any person shall ride, lead, or drive any horse or other animal upon such road, and within such fences and guards other than at farm crossings, without the consent of the corporation, he shall for every such offence, forfeit a sum not exceeding ten dollars, and shall also pay all damages which shall be sustained thereby to the party aggrieved.

Sec. 43. Every such corporation shall, within a reasonable time after their road shall be located, cause to be made:

1. A map and profile thereof, and of the land taken or obtained for the use thereof, and file the same in the office of the state engineer and surveyor. And also like maps of the parts thereof located in different counties, and file the same in offices for recording deeds, in the county in which such parts of said road shall be, there to remain on file as of record forever. Every such map shall be drawn on a scale and on paper, to be designated by the state engineer and surveyor, and certified and signed by the president of such corporation.

2. A certificate specifying the line upon which it is proposed to construct the railroad, and the grades and curves.

Sec. 44. If any such corporation shall not, within two years after its incorporation, begin the construction of its road, and expend thereon ten per cent. on the amount of its capital, and finish the road and put it in full operation in five years, its act of incorporation shall become void.

Sec. 45. The legislature may, at any time, amend, or annul, or repeal any incorporation formed or created under this act; but such amendment or repeal shall not, nor shall the dissolution of any such corporation, * its stockholders or officers for any liability which shall have been previously incurred.

Sec. 46. All existing railroad corporations within this state, shall respectively have and possess all the powers and privileges, and be subject to all the duties, liabilities, and provisions contained in this act, so far as they shall be applicable to their present conditions, and not inconsistent with their several charters; and all railroad companies that are now constructing their roads, may acquire title to lands necessary for that purpose, under the provisions of this act: *Provided* that nothing in this act contained, shall authorize any existing rail-

* An omission in the paper from which this law is copied.

road company to carry freight without the payment of canal tolls, pursuant to the act entitled "An act relating to the transportation of freight on certain railroads," passed May 12, 1847.

Sec. 47. This act shall take effect immediately.

State of New York, } I have compared the preceding with the ori-
Secretary's office. } ginal law on file in this office, and do certify that the same is a correct transcript therefrom and of the whole of said original.

CHRISTOPHER MORGAN, *Secretary of State.*

Amer. Mining Jour.

On Tables for Setting out the Width of Cuttings and Embankments on Sidelong Ground; and also Formulæ for Computing the Area of Vertical Section.

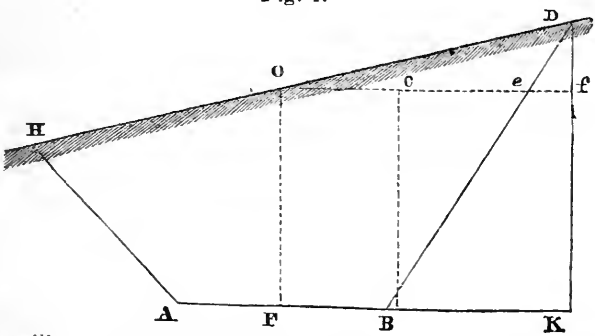
By R. G. CLARK, C.E.

The object of this paper is to investigate some simple formulæ, and from thence to construct some tables, to enable the assistant engineer or contractor to set out the widths of cuttings and embankments on sidelong ground; and also to calculate the solid content of any portion of the ground. The subject may be resolved in the following proposition:—

Given the ∠ of inclination of ground, the depth (from field-book, &c.) of ground to the centre of balance or formation level, and the ratio of the slopes; to determine where they will meet the ground at surface.

Let H A F B D (fig. 1.) be a vertical section of the ground; A B the formation line, represented by $2\ b$; the given angle of inclination of ground H D with the horizon by θ; the given depth O F from the stake O perpendicular to centre of formation level denoted by a.

Fig. 1.



1. We will proceed first, to determine a formula for O D. Let it be x; draw D K perpendicular to A B produced; O f parallel to A B K. Let D B be the given slope m base to 1 perpendicular; draw the vertical B C.

Let D $f=y$; then O $c=$ F B$=b$; $e\,f=m\,y$; also by similar triangles, C $e=m\,a$. $\therefore$ O $f=b+m\,a+m\,y$.

Now, by triangle O f D, right angle at f, we have

$$1 : x :: \sin\theta : y. \quad \therefore\ y = x.\sin\theta.$$

$$\text{Again, } 1 : x :: \cos\theta : b + m\,a + m\,y.$$

$$\therefore\ x.\cos\theta = b + m\,a + m\,y.$$

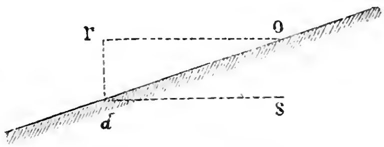
Eliminating y, then $x\,(\cos\theta - m\sin\theta) = b + m\,a$;

$$\text{therefore, } x = \frac{b + m\,a}{\cos\theta . - m\sin\theta} \quad \ldots\ldots\ldots\ldots (1)$$

From the factor, $\dfrac{1}{\cos\theta - m\sin\theta}$ of the above formula, the Table No. I. is computed from 5° to 20°.

2. To find an expression for O H measured from O on the descent. Draw H M (fig. 2) perpendicular to A B produced. Let H A be

Fig. 2.



the given slope, ratio as before. Let H M $= y'$; then will A M $= m\,y'$.

Therefore, H G $=$ N F $= b + m\,y'$ also O $g = a - y'$.

By the triangle H g O we have $1 : x' :: \sin\theta : a - y$;

therefore, $a - y' = x'.\sin\theta$; and $y' = a - x'.\sin\theta$.

$$\text{Again, } 1 : x' :: \cos\theta : b + m\,y'.$$

Eliminating y, we have $x'\,(\cos\theta + m\sin\theta) = b + m\,a$;

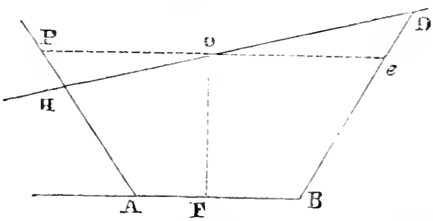
$$\text{therefore, } x' = \frac{b + m\,a}{\cos\theta + m\sin\theta} \quad \ldots\ldots\ldots\ldots (2)$$

From this expression, Table No. II. is calculated by the factor

$$\frac{1}{\cos\theta + m\sin\theta}.$$

3. We shall now investigate an expression for the area of the vertical section; the inclination of ground, depth, breadth of formation level, and lengths x, x', and also the ratio of slope, being all given.

Fig. 3.



Through centre O (fig. 3), drew P e parallel to A B; then P O $= b + m\,a$. $\therefore$ area of trapezoid P A B $e = (2\,b + m\,a)\,a$;

area of triangle P O H $= \frac{1}{2}\sin\theta.\,x'\,(b + m\,a)$;

and area of triangle D O $e = \frac{1}{2}\sin\theta\,x\,(b + m\,a)$.

Consequently, the whole area of trapezium or vertical section = area P A B e + area triangle D O e — area triangle P O H =

$$(2\,b+m\,a)\,a+\tfrac{1}{2}\,(b+m\,a)\,(x-x')\sin\theta \;\;\ldots\ldots\ldots\ldots\;\; (3)$$

The first column of the table gives the angle of inclination of the ground, and the adjoining column the nat. sines to three places of decimals, to facilitate working out the area, as in equation (3). We shall now commence with the following Rules.

I. *To find the two lengths* O D *and* O H :—RULE. Add the half-breadth of formation level to the product of the slope and given depth; then multiply this sum by the corresponding tabular number, then will each product be equal to each length required.

II. *To find the area of section* H A B D :—RULE. 1st. Add the formation level to the product of the ratio and depth, and multiply this sum by the depth. 2ndly. Add half the formation level to the product of ratio and depth; multiply this sum by the difference of the two lengths, and again by nat. sine of angle. Add these two products, and their sum will be the area.

Example 1.—Given the angle of inclination of ground 18°; slope, 1 to 1; depth, 45 feet; and breadth of formation level, 30 feet. To find distances of centre stake, area of section, and cubic content, when 100 feet in length.

Here $b+a\,m=15+45=60$; $m=1$; $\theta=18°$; its nat. sin $=\cdot309$ ∴

$1.557\times60=93\cdot429=$ O D. $\cdot799\times60=47\cdot940=$ O H.

By formula (3) we have $(30+45)\,45+\tfrac{1}{2}\,(15+45)\,(45\cdot48)\,\cdot309=75\times45+30\times45\cdot48\times\cdot309=4099\cdot5$ area required.

Cubic content $=409950\cdot0$.

Example 2.—Given angle of inclination of ground, 20°; slope, $1\tfrac{1}{2}$ to 1; depth, 50 feet; and breadth of formation level, 30 feet. To determine distances and also area.

Here $a=50$; $b=15$; $m=1\tfrac{1}{2}=\tfrac{3}{2}$; $\theta=20°$; its nat. sin $=\cdot342$ ∴ $b+a\,m=15+75=90$.

Now, $2\cdot344\times90=210\cdot96=$ O D. $\cdot781\times90=70\cdot29=$ O H.

By formula (3) for area we have

$(30+75)\,a+\tfrac{1}{2}\,(15+75)\,(140\cdot67)\,\cdot342=\cdot7174$ area required.

Example 3.—Given the inclination of ground, 18°; slope to be 2 to 1; depth from field-book, 20 feet; breadth of formation level, 30 feet. To find area and distances.

Here $b=15$; $a=20$; $\theta=18$; $m=2$. ∴ $b+a\,m=55$.

$55.\times3\cdot000=165.=$ O D. $55.\times\cdot641=35\cdot25=$ O H.

By formula (3) we have

$(30+40)\,20+\tfrac{1}{2}\,(15+40)\,(129\cdot74)\,\cdot309=2505$ area required.

Remark.—If the ground should ascend and descend, as in the adjoining diagram (fig. 4), then Table No. II is to be used to find the distances. Table No. I will in like manner be required for ground descending from centre, as in fig. 5.

Fig. 4.

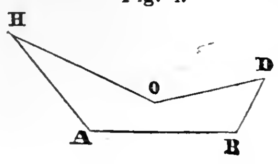
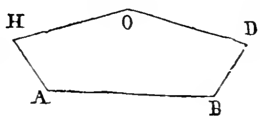


Fig. 5.



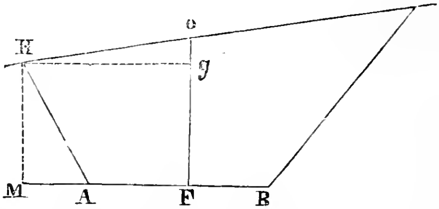
The tables will likewise do for embankments—No. I. for the ascent from centre stake, and No. II. for the descent.

We shall now discuss the equations (1) and (2). Put them respectively under the following forms. T, T', being tabular numbers, $A=b+m\,a$.

$$X=T.A;\ \text{and}\ X'=T'.A.$$

Divide by T, T', respectively; then $\frac{X}{T}=\frac{X'}{T'}$, A being eliminated. Therefore the two distances, x and x', are to each other as their respective tabular numbers; consequently the distances can be proved by a second operation. The Tables might have been carried up to 45°, but then they would require a greater number of places of decimals to insure greater accuracy.

Fig. 6.



In taking the angle of inclination, the clinometer or common theodolite might be used; but if the spirit-level should be used, then we have only to measure from O downwards *any* distance, O r, (fig. 6), and then take the height with instrument; and then will the sine of angle of inclination O $d\ s=r$ O $d=\frac{\text{height}}{\text{distance}}$.

Angle.	Nat. Sin.	TABLE No. 1.—For O D. 1 to 1	1½ to 1	2 to 1	TABLE No. 2.—for O H. 2 to 1	1½ to 1	1 to 1.
5°	·087	1·100	1·156	1·217	·854	·881	·926
6°	·105	1·124	1·193	1·273	·832	·868	·910
7°	·122	1·148	1·230	1·323	·802	·851	·895
8°	·139	1·175	1·280	1·404	·780	·835	·885
9°	·156	1·203	1·328	1·496	·761	·820	·873
10°	·174	1·233	1·380	1·570	·752	·804	·856
11°	·191	1·265	1·437	1·666	·736	·790	·850
12°	·208	1·279	1·500	1·778	·700	·780	·844
13°	·225	1·330	1·566	1·902	·705	·763	·841
14°	·242	1·372	1.655	2·055	·696	·752	·826
15°	·259	1·414	1·731	2·230	·676	·740	·818
16°	·276	1·459	1·825	2·463	·663	·727	·800
17°	·292	1·506	1·930	3·600	·645	·717	·801
18°	·309	1·557	2·050	3·000	·641	·710	·799
19°	·326	1·613	2·186	3·040	·630	·698	·787
20°	·342	1·673	2·344	3·913	·611	·680	·781

Civ. Eng. & Arch. Jour.

Improvement in Railway Sleepers.

The chief objection that has been raised against the employment of sleepers in the construction of railways, is their liability to decay, and the necessity that exists of renewing them from time to time. Kyan's corrosive sublimate, which has been employed for preserving them, has been found in France and elsewhere to be too expensive a process, and crude creosote, different sulphates, and pyrolignite of iron, have all been successively tried, but with results by no means satisfactory. We are therefore glad to introduce Mr. Fred. Busse's invention for constructing railway sleepers from a certain compound cast around a wooden frame, which he has called "*terresin.*" The following is his own description of his invention:—

"My sleepers are manufactured by hand, just on the spot where they are wanted. These sleepers have been tried on the Leipsic and Dresden, and the Dresden and Silesia lines, and combine all the advantages which are reasonably to be expected from a good sleeper. They are easy to make, are cheap and solid, and promise a duration for a period of time not to be calculated; supposing only thirty years, it greatly exceeds that of wooden sleepers. I have cast sleepers, according to my invention, 8 ft. long, 14 in. broad at the base, at an outlay amounting to less than 1 Prussian dollar (3s.) the piece. The yet good pieces out of the old worn sleepers may be advantageously cut for frame top pieces. The principle of my invention is to inclose a frame of entirely dry, well-seasoned wood, air-tight, in a substance which is not affected by the influences of wet and air, it being the result of experience that under such circumstances, the wood will not be destroyed at all, or at least will last by far longer. The method after which I build and compose the said sleepers is as follows:—I take two pieces of wood, dried to the highest degree by artificial heat in a stove. Immediately after drying, I dip those pieces in a boiling compound of 10 lb. of brimstone, and 100 lb. of coal tar, to which I add 80 lb. of very fine powder of caustic lime. This done, I scratch or take off with a knife the superfluous compound, leaving only a thin coating on the wood. The pieces of wood thus prepared are now brought anywhere along the line of the railway where coarse gravel is to be found; it may be taken out of the soil or from a river. The latter is to be preferred, as containing less earthy matter. The gravel mixed with fine or coarse sand, or small stones—the latter till to an inch diameter—ought to be dried, or rather heated before used. The wooden frame is placed, the topside to the bottom, in a conical iron or wooden mould—the latter material is to be preferred—which is to be filled up with the compound which I call "terresin" and which is prepared as follows: I take an iron vessel, large enough to hold a quantity of terresin, sufficient to cast three sleepers; I melt 10 lb. of brimstone, add 75 lb. of stiff coal-tar, and mix it by stirring with 100 lb. of fine powder of well-dried fresh-burnt caustic lime, which is slaked in the air or with a little water. Where powdered chalk or plaster are cheaper, these materials may be used as well The exact

quantity of lime, chalk, or plaster, for a given quantity of brimstone and coal-tar is dependent upon the quality of the said materials, and the choice of the right proportion must be left to the best judgment of the manager. In case the tar should not be of good quality, a little resin and grease may be added. To this compound add, always stirring and turning the mass over a gentle fire, 10 to 12 cubic feet of that before-mentioned dried or heated gravel, and fill or rather ram the thick hot compound into the moulds in which the frames are placed. The moulds must before-hand be well coated with clay, and afterwards sifted over with fine ash, to prevent the compound adhering to the mould. Before the compound is cooled, it is advisable to pierce one or two holes through the top part of the sleepers, vertically to the bottom, with an iron bar. By these means the sleepers and rails may be levelled or balanced as accurately as possible, by pressing dry sand into the holes, which will leave the sleeper spreading under the bottom part. The sleeper being completely cooled, it is taken out by overturning the mould. The top pieces, where the rail or the chair is to be screwed (which is by far the better process) or nailed down, must be left free from the compound, and are only coated with the thin hot compound, without the gravel, which may be repeated after having fastened the chair, to secure the top pieces against the influence of air and water.

By this contrivance we get a very cheap sleeper, as hard as stone, and extremely heavy—400 lb.—without losing the elasticity which is wanted to a certain degree, and allows, what is a matter of importance, that the rails or chairs are situated directly on wood. Here I feel obliged to remark that we have found it in Germany a good practice to support the sleepers only on the two extremities, leaving the gravel or sand loosely underneath the middle part, an experience undoubtedly made likewise in England. It is a matter of importance that any kind of wood may be employed, and that the construction of the frame and the size of the sleepers may be altered according to circumstances. The sleepers may be made much wider with a proportionate small increase of expense. The thin terresin, without gravel, can be used with great advantage to cover the surface of the wooden sleepers already laying, which after that preparation, will last longer. In case of using the terresin for this purpose, I expect a commission of £1 for every 1000 pieces thus covered, and if it is employed for covering roofs, bridges, viaducts, houses, pavements, floors, &c. 2d. for the square yard. For those different purposes it is advisable to add about 3 to 10 per cent. of animal grease, tallow, train-oil, &c. For floors, pavements, &c. the same compound is used as for sleepers, without any grease.

Regarding the resistance against pressure, it is to be observed, that sleepers on the Leipsic and Dresden Railway have undergone, without the least alteration, the pressure of the heaviest trains, with 20 ton locomotives. Their firmness and compactness is beyond all doubt, and their cohesion so great, that it was only with great difficulty that a sleeper of this kind could be broken up with iron chisels and hammers.

The Artizan.

Description of a Method of setting out Railway Junctions. By ARTHUR BEAULANDS.

The object of the paper was to supply a methodical rule for setting out that portion of a branch line of railway included between the rails of the main line.

The author observed that, in all ordinary cases, the curve of the branch line could not be set out from the main line, which was supposed to be straight, by the ordinary methods of setting out railway curves, since the Junction was required to make an offset of four to five inches in the length of the switch-rail, which was much greater than the offset made from the tangent in the same length by a curve of moderate radius, so that it was necessary to make the Junction line abruptly at a finite angle with the main line.

He therefore considered the Junction curve to be determined by its passing through three given points; namely, the two extremities of the switch rail and the furthest point of crossing; and from these data he showed how the radius and centre of the circular arc might be found, as well as the positions and angles of the various crossings.

To render the method more easy of application, the author gave a table calculated from the principles and formulæ laid down in the paper, assuming an ordinary form of the switch, and a series of values of the lead, a distance of the furthest crossings extending to the greatest limit likely to occur in practice.

In the course of the discussion which ensued upon this method as compared with the ordinary system of setting out Junctions by a comparatively empirical rule, well understood and practised by the platelayers on railways, Mr. Wild's switch was alluded to and exhibited. In this switch all notching and inequality in the bearing surfaces of the fixed rails were shown to be avoided, by the ends of the tongues being housed under such surfaces instead of being notched into them; the tongues being consequently at their points, and for some distance beyond them, lower than the fixed rails, exercised, where they were weakest, merely a lateral action against the wheels without bearing any of the weight of the passing trains.

Several engineers who had employed these switches extensively, expressed themselves relative to them in very commendatory terms, and stated that they were not only manufactured in a very superior manner, but that their action was very perfect, and that they tended greatly to the prevention of accidents in railway traveling.—*Proc. Inst. Civ. Engineers.* Artizan, May, 1848.

Observations on the Resistances to Railway Trains at different Velocities. By MR. D. GOOCH, of the Great Western Railway.

For the purpose of performing the experiments, a dynamometer carriage was constructed at Swindon, in which all the results required were registered upon a large scale, on the same roll of paper, thus

exhibiting at one view, and in the same period of time, the tractive power exerted upon the train, and the force and direction of the wind; the registration of the results was made upon the paper at every sixteenth part of a mile, and the time was registered in correspondence with the distance traversed during every fifth part of a second. The dynamometer spring used was 7 ft. 6 in. long, and very carefully arranged. It was only necessary to count the number of seconds or fractions of a second, in one or more of the distance divisions, and the speed was accurately ascertained. The force and direction of the wind was ascertained by a wind gauge, placed 5 feet above the top of the carriage, with the connexion brought down to pencils, which indicated on the same sheet all the results. Indicator cards were also taken simultaneously from the steam cylinders as frequently as was practicable, but not continuously, as it was a service of some danger, the experimenter being obliged to sit on the buffer-beam of the engine at a velocity of 60 miles per hour, and in that windy position to take off four sets of cards in three quarters of a minute. The spot selected for performing the experiments was one mile of railway perfectly straight and level, and nearly on the surface of the ground; and in the plan the height of the trees, hedges, and every intervening object which could affect the influence of the wind, is clearly marked. The experimental train consisted of first and second-class carriages, each on six wheels, 4 feet diameter, taken indiscriminately from the working stock, and loaded with iron to represent a fair load of passengers, giving a gross weight for each of 10 tons. The experiments were tried with various weights and speeds up to 100 tons and to 62 miles per hour, and the results were classified and arranged in a tabular form, with copious explanatory headings, so as to render reference to them exceedingly easy.

The author first reviewed the deductions of Mr. Wyndham Harding's formula, which was given at the discussion at the Institution in 1846, and gave his reasons for dissenting from that formula. He then examined critically several experiments recorded in the tables, stating candidly all the exceptions that could be taken to them; showing that although there was a difference of as much as 72 per cent. shown between the resistance as calculated by Mr. Harding's formula and the experiments made by Mr. Gooch, that difference might be accounted for by the methods employed by Mr Harding, which were objected to, as calculated to produce erroneous results: viz., allowing carriages to run down inclines by their own gravity, using wheels of 3 feet diameter instead of 4 feet, having a much greater length of train for the wind to act upon, &c. He reviewed the great effect of a side wind against a train—driving the flanches of the wheels against the rails; and argued that the length of a train of carriages was much more important than its own weight. The author did not offer any formula that should be applicable for calculating the resistance of all railway trains; but his tables gave examples of almost every case that could occur, and thence data could be supplied for those who wished to carry the investigation further, and make a formula for themselves. He arrived at the conclusion that in practice the friction of the axle-

journals was not a constant quantity at all speeds, and thought that the number and diameter of the wheels in a train, in proportion to the weight, should form elements in any general formula. He showed by experiments that the total atmospheric resistance to a train weighing 50 tons differed but slightly from that to a train of 100 tons weight, if the carriages were small and the train long in the one case, and the reverse in the other case.

The general result of the diagram of resistance with trains of 100 tons and with 50 tons, showed that the resistance calculated by the narrow-gauge formula with a 50 ton train, at 62½ miles per hour, was 37 lb.; with a train of 100 tons, by the same formula, at 61 miles, it was 31½ lb. The broad gauge resistance, with a train weighing 50 tons, at 62½ miles per hour, was under 23 lb.; and with a train weighing 100 tons, at 61½ miles per hour, was 22½ lb. We cannot, of course, give fully the results, except in a comprehensive form, but such were the general results.

The author concluded his paper by saying that it appeared to him necessary, before any general formula for calculating the resistance to railway trains could be made, that the value of the following elements, necessary in such formula, should be determined by experiments:—

1. The axle-journal friction, at different velocities and with different weights, per square inch of journal surface.
2. The resistance to the rotation of the wheels and axles per pair, at different velocities, and with different diameters.
3. The resistance due to the rolling of the wheels upon the rails, with different weights upon them, and with different diameters.
4. The resistance due to the passage of the train through the atmosphere, at different velocities, with different proportions of weight, and length and breadth of train.
5. The resistance due to the oscillation or unsteady motion of the train, at various speeds.

The author considers that all these values might be determined, with a considerable degree of accuracy, by careful experiment.—*Proc. Inst. Civ. Engineers.* Lon. Civ. Eng. & Arch. Jour.

On the Prevention of Priming in Steam Boilers. By John Harris, *Engineer.*

In an article "On the Prevention of Priming in Steam-Boilers," Mr. W. Scotton, engineer, R. N., proposes to use oily or fatty substances for the prevention of priming. It is a well-known fact that oil, or tallow, or any fatty substance, is a great preventive of priming in ordinary steam boilers, but for locomotive boilers the case is quite the reverse. For instance, when a new engine is placed on a line, it is continually priming until the boiler is well washed and cleansed; locomotive boilers all being tubular, and having very little steam room, the space allowed is necessarily very small. Another disadvantage attending the use of oily matters is, their tendency to cause the impurities held in solution in the water to be deposited on the lower

plates of the boiler, in contact with the fire. As a proof of the above facts, I beg to state, that I fixed a high-pressure engine, of 10-horse power, at the London-Bridge Railway Station, about six years ago; but the steam from the exhaust-pipe proving an annoyance on the line, and there being a water-tank over the engine, containing 18,000 gallons, I proposed, and was authorized, to fix a coil of 4-inch pipe at the bottom, which effectually condensed the whole of the steam. In a few weeks after, however, we were nearly causing an explosion by returning the condensed water back to the boiler, in consequence of the oily matter combining with the water from the steam cylinder. We were greatly surprised one day, while the engine was at full work —the steam being at that time at a pressure of 50 lbs. on the square inch—to hear a loud hissing noise in the furnace. On opening the fire-door, we saw that a row of rivets, 5 feet long, had given way, and that the water was coming out with enormous force. We instantly put out the fire, and on the following morning I went into the boiler, to ascertain the cause of so unusual an accident—the boiler being provided with a gauge-glass and two gauge-cocks, and the water at the time having been rather higher in the glass, and fuller at the cocks, than usual. On entering the boiler, I found a mass of sediment over the whole of the rivets which had given way, about 3 inches thick, which prevented the water coming in contact with the plate of the boiler, and thereby caused the rivets to become red hot, and a consequent expansion of the sediment, which allowed the water to come suddenly in contact with the rivets and plates of the boiler. We examined the sediment taken out, in various ways, and found it to contain at least 50 per cent. of oily matter. The water used was Thames water. Since that time—that is to say, for the last five years —we have used, as a preventive against a similar occurrence, a small quantity of common soda, which, combining with the oil or tallow, causes the whole of the earthy matter held in solution to float on the surface of the water; and, by means of a blow-off pipe, placed on the surface of the water in the boiler, the whole of the sediment is removed. The consequence has been, that we have had not the least occasion to clean the interior of the boiler, the plates and rivets remaining as clean as when first manufactured. Mech. Mag.

London-bridge Railway Station, May 2.

AMERICAN PATENTS.

List of American Patents which issued in the month of August, 1842, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Manufacture of Iron;* John S. Gustin, (assignor to Peter Cooper,) City of New York, August 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of atmospheric air, introduced directly upon

the heated iron in the furnace, in the manner and for the purposes set forth and described."

2. For an *Improvement in Looms for weaving Counterpanes, &c.;* Erastus B. Bigelow, Lancaster, Massachusetts, August 2, (antedated May 2d, 1842.)

The patentee says,—"The improvement for which I now claim a patent, consists: First, in the manner in which I construct and arrange the toothed gearing, so as to obtain the power that is necessary for the lifting of the weights which are suspended from the harness in looms, intended for figured weaving, which weight with the friction consequent thereon, produces a very considerable resistance which it is necessary to overcome.

"Secondly, In the arrangement of the parts concerned in the stopping of the loom by the manner in which the protecting rod acts thereon.

"Thirdly, In an apparatus for counteracting the momentum of the loom, when it is thrown out of gear for changing the spools, or for any other purpose."

Claim.—"What I claim as constituting my improvement on the power loom for weaving counterpanes and other figured fabrics, and which I desire to secure by letters patent, is the manner in which I have combined the rotating shaft with the other parts connected with the stopping of the loom: that is to say, I claim the allowing of the bayonet of the protecting rod to pass freely beyond the projecting piece on the rotating rod or lever, against which it strikes, so as to prevent the sudden arresting of the lathe, or the motion of the loom by said bayonet, when the shuttle does not arrive at its place within the shuttle box, but remains in the warp; and in this part, I likewise claim the combining with the rotating shaft, or lever, the sliding shaft and its appendages for acting upon the stop lever, and the suddenly arresting the motion of the loom by said stop lever at the time, and substantially in the manner herein described.

"I claim likewise the combination of the friction pulley and band, with the apparatus for stopping the loom, said friction pulley and band, or other device, being connected with the loom, and operating substantially in the manner and for the purpose herein set forth."

3. For an *Improvement in Clocks;* Evans Casselberry, St. Louis Missouri, August 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode herein described, of applying the expansion and contraction of mercury or other fluids, for the purpose of operating clocks, and other combinations of mechanism driven by springs: that is to say, I claim operating the shaft on which the driving spring is wound up by means of the expansion and contraction of mercury acting in a cylinder against a piston; said cylinder and piston being combined by means of a movable frame, consisting of bars and a ratchet wheel, with the aforesaid shaft, all as herein set forth.

"I also claim the combination of the shaft constructed in two parts, with the spring and pin on said spring as described, for the purpose herein specified."

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4. For an *Improvement in Wind-Mills;* Alexander McGrew, Cincinnati, Hamilton county, Ohio, August 2.

Claim.—"I do not claim to have invented the wind-mill, but the nature of my invention consists in an improved mode of constructing the wind wheel, screening or protecting one part of the floats or fans from the action of the wind, while at the same time the other receives its full force nearly at right angles to their plane or surface, so as to produce more power, and in having the different parts so contrived as that it shall, in a great measure, regulate itself, and admit of its being used stationary or in locomotion, either in wind or water.

"What I claim as my invention, and wish to secure by letters patent, is the revolving frame and screen in combination with the regulator or governor, in the manner and for the purpose herein set forth."

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5. For an *Improvement in Cheese Presses;* Chester Stone, Rootstown, and F. K. Collins, and G. S. Collins, Ravenna, Ohio, Aug. 6.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of the power of the screw and falling lever in a self-acting press, in manner as above described, for the purpose of pressing cheese and other substances, whether arranged precisely in the manner herein set forth, or in any other mode, substantially the same."

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6. For an *Improvement in Steam Boilers;* Abram S. Valentine, Bellefonte, Centre county, Pennsylvania, August 6.

The patentee says,—"The nature of my invention consists in forming two square or other shaped reservoirs, which are connected together by tubes standing vertical, their ends opening into said reservoirs. The front tubes of the boiler thus constructed, are made to form the back of the fire chamber. From the lower reservoir, a fire grate extends upwards at an angle of about 70°; the smoke, &c., passes through between the pipes and up the chimney at the back of the boiler."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the generator, consisting of the separate steam chamber or upper reservoir, and lower separate reservoir, so as to allow them to move apart, as the tubes which unite them expand in the manner above described, in combination with the fire chamber, formed between the tubes of the boiler and grate, constructed and arranged in the manner and for the purpose herein set forth."

7. For an *Improvement in cutting out Hoop and Basket Stuff;* Charles Stratton, Brattleboro, Windham county, Vermont, Aug. 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the knife and rest which regulates the thickness of the article to be cut as herein described, and also the combination of the knife and guide for the purpose and in the manner specified."

8. For an *Improvement in Cooking Stoves;* Erastus Buck, Nunda, Alleghany county, New York, August 6.

The patentee says,—"The nature of my invention consists in placing the furnace or fire chamber over the oven nearly at the back part of the stove, and forming a diving flue on each side of the front doors of the fire chamber, which extends down under the oven and up in the rear of the fire chamber, and there connects with the pipe."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a fire chamber placed over the oven at its rear, with the diving flues projecting in front and passing around the oven in the manner and for the purpose herein described."

9. For an *Improvement in Cotton Presses;* Parry W. Porter, Columbia, Maury county, Tennessee, August 11.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described addition of the levers, operated by the screw in such manner that, in turning the screw to the right or left, the operation of pressing will continue without cessation, as one pair of platens will be pressing the bales whilst the other pair will be receding from the opposite bales—the power applied being by means of cords and pulleys, or any convenient mechanical power. I likewise claim the combination of the curved levers as represented, and the movable fulcra by which the sides of the rhombus are drawn together as described."

10. For an *Improvement in Lard Lamps;* John T. Creighton, Alexandria, D. C., August 11.

The patentee says,—"My improvement is in the conductors and in combining with the central conductors a sliding clasp which embraces them and the wick."

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the manner of holding the wicks by means of the sliding clasp and the central spring conductors, constructed, arranged, and operated in the manner set forth, or in any other mode analogous thereto."

11. For an *Improvement in the mode of changing Reciprocating into Rotary Motion for Steam Engines and for other purposes;* Alexander M. Bouton & Andrew Perry, Newark, Essex county, New Jersey, August 18.

The patentees say,—"The nature of our invention consists in our applying power by a certain combination of levers upon the edge or circumference of a wheel, which is hung upon the main shaft or axle used to propel a steam boat, or other main axles for driving machinery, in the room and place of an ordinary crank, by which mode we conceive that we gain power and save weight."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the levers in combination with the wheel, having notches cut on its rim and the arrangement of parts for pressing the levers into the notches for the purpose, and in the manner specified."

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12. For an *Improvement in Cutting the Threads on Wood Screws;* Cullen Whipple, (assignor to Alexander Hodges,) Providence, Rhode Island, August 18.

This machine is intended simply to cut the threads or worms upon the blanks, which are to be formed into wood screws, after the heading and cutting of the nicks or slits in the heads have been completed.

Claim.—"What I claim as new, and desire to secure by letters patent, are the following parts, and combinations of parts, as set forth in the foregoing specification:

"I claim the manner in which I have combined the shaft with the circular wedge on the shaft, so as to cause said circular wedge to raise the shaft by its action on the projecting piece and the tube, said tube being connected with the box, and the whole being arranged, and operating substantially as set forth.

"I claim the manner in which I have constructed, arranged, and combined the conical cam, furnished with the recesses, with the lever, the shaft, and the cutter arm, so as by their combined action, and that of their immediate appendages, the cutter may be forced against, and removed from, the blank to be cut, at the proper intervals, and in the manner described. I claim the regulating the feed of the cutter in its successive operations on the blank, by the raising of the conical cam, so as to cause a part of larger diameter to act upon the lever. I claim the so forming of what I have denominated the conical cam, as to give the desired taper to the screw, to be cut by means of the increasing radius of its curvature as set forth. I claim the manner of raising the conical cam by means of the lever, by the action thereon, of the pins on the ratchet wheel as set forth. I claim the manner in which I have combined, and arranged the lever, its catch, or pall; the cam on the shaft; the rim or flanch of the rachet wheel; and the clutch by means of its arm, so as to co-operate with each other, and with the lever, in governing and regulating the cutting of the screw. I claim the manner of making or forming the cutters or chasers, to be used in combina-

tion with a machine for cutting wood screws, said cutters having a groove formed along their cutting sides, so as to cause them to cut simultaneously on both sides of the thread, and finally to cut the edge of the thread itself, said groove being of the proper width and depth for that purpose, by which construction the cutters or chasers may be sharpened, by grinding or setting them to a simple bevel at their ends, without interfering with the notch or groove, by which they are made to cut on each side of and to form the thread."

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13. For an *Improvement in the mode of Securing a Bobbin in the Shuttle;* Daniel Leavitt, Cabotville, Hampden county, Massachusetts, August 18.

Claim.—"I claim the movable box, or socket, (which receives the head of the bobbin,) constructed as described, the same being arranged upon the spring lever, and operating substantially in the manner and for the purpose as herein set forth."

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14. For an *Improvement in Tanning Leather;* William Zollickoffer, Middleburgh, Carroll county, Maryland, August 18.

The patentee says,—"The nature of my invention consists in using in combination, the muriate of soda, supertartrate of potassa, and tartaric acid, as a bate for bating all description of hides and skins."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the muriate of soda, supertartrate of potassa, and tartaric acid, as a bate for bating all description of hides and skins as herein described."

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15. For an *Improvement in Water Wheels;* Joseph Durkee, Binghampton, Broome county, New York, August 25.

The improvement consists in the construction of the buckets so made, that the whole lateral and perpendicular pressure of the water used, acts to the greatest advantage in propelling the wheel by re-action.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of the taper bucket above described."

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16. For an *Improvement in Churning Butter;* N. H. Lindley, Redding, Fairfield county, Connecticut, August 25.

Claim.—"Having thus described my invention, I shall claim the combination of the vibrating floats or scrapers, fluted roller of the dashers, and the stationary bottom of the reservoir, the whole being constructed, and operating together, substantially in the manner and for the purposes as hereinbefore set forth."

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17. For an *Improvement in Locomotive Steam Engines;* Matthias W. Baldwin, Philadelphia, Pennsylvania, August 25.

Claim.—"What I claim as new, and desire to secure by letters patent, is principally the manner in which I connect the four truck wheels

with each other, so as to enable them to vibrate, and to adapt themselves to the curves and undulations of the road, by the combined action of the pins or pivots, the vibrating bars, with the box and the boxes, and plummer blocks of the axles, with their cylindrical fittings, the whole being constructed, combined, and arranged substantially in the manner herein set forth, the respective parts co-operating with each other, upon the principle, or in the manner above made known and described.

"I do not intend to claim, nor do I claim, either of the parts above described, taken separately or individually."

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18. For an *Improvement in Brakes for Railway Cars;* John R. Grout, Utica, New York, August 25.

Claim.—"Having thus fully described my machinery, and the manner of using it, what I claim as new therein, and desire to secure by letters patent, are the following, that is to say:

"I do not claim any one of the parts of the engine, tender, or car, separately and independently of the arrangements and combinations herein set forth and claimed, nor any combination, or combinations of parts not herein especially named and claimed as my invention and improvement. But I do claim as my invention and improvement, in the first place, the manner in which the momentum of the cars operates the brake of the tender, by means of the fixture upon the first car and the rocking shaft, jointed slide rod, and springs in the tender, the same being combined and operated substantially as hereinbefore described. Secondly, The particular manner in which the slide and lever in the car are arranged and operated as described; including in said claim, the manner in which the resistance of the tender operates the brake of the car, or cars in train, by means of the rod in the tender; and the slide lever, rods, springs, and rocking shaft in the car, the whole being combined and operating substantially as before described.

Thirdly, I claim the manner in which I combine and arrange the respective parts of the regulator: that is to say, I claim in combination the forked lever, attached to the rocking shaft, the sliding tube which plays upon the shaft, to which the lower ends of the arms of the regulator are attached; the wheel to which the upper ends of said arms are attached, which wheel, by its friction upon a friction plate or wheel, communicates the action of the arms of the regulator to the machinery beneath; by which arrangement, when the momentum of the train is suddenly diminished, the arms with their weights and the tube, may continue their motion, thereby preventing the rupturing of the apparatus, which would result from the attaching of the arms of the regulator to the shaft, as has heretofore been done.

"The mechanical arrangements all being the same, substantially as herein before described, or varying therefrom only in form, which, it will be evident to every one conversant with mechanics, may be done without an invention, or the introduction of any new principle."

19. For an *Improvement in Wheels, and Tyres of Wheels, for Rail Roads;* Thomas Banks, Manchester, England, August 25.

This improvement in the construction of wheels, and tyres of wheels, consists in placing, inserting, or applying a bar or bars of steel in a groove formed in the periphery of railway wheels, or tyres of wheels, such groove being suitably turned, or otherwise formed, to receive the steel bar, or bars.

Claim.—"I claim, therefore, as an improvement in the construction of wheels, or tyres for wheels, to be employed upon railways, placing, inserting, or applying a bar, or bars, of steel in a groove, turned or formed in the said wheels, or tyres, the steel part not being welded to or with the wheel, or tyre, but capable of being easily removed when worn and replaced by new steel.

"I would remark, that a modification of this invention may be made by substituting iron bars for steel in the tyre of those wheels, where the expense of the steel is not desirable."

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20. For an *Improvement in Ploughs;* Jairus F. Tefft, Amherst, Erie county, New York, August 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the mouldboard and shares of a plough, so that a share can be applied to either the upper or under side of the mouldboard, in the manner and for the purpose herein set forth.

"I also claim the inclination of the cutter and land side, so as to cut a rhomboidal furrow slice as above described."

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21. For an *Improvement in Lamps;* John Grannis, Oberlin, Loraine county, Ohio, August 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the forcing pump described in the foregoing specification, and its application in the construction and use of lard lamps."

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22. For an *Improvement in the Rotary Steam Engine;* Solomon M. Eby and David N. Phelps, Jefferson Township, Richland county, Ohio, August 26.

The patentees say,—"The nature of our invention consists in the peculiar construction of the engine by which a regular rotary motion of the wheel is produced, by the direct action of the steam to sliding heads of said wheel."

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is passing the steam through the revolving wheel and sliding piston, from one side to the other, causing the steam to act simultaneously against the end of the piston in passing the steam chambers in the fixed head, and against the flat side of the opposite end of the piston in passing through the interior of the cylinder, thus forcing out the piston from the wheel, and closing the joints between

the flat side and end of the sliding valve, and the surfaces of the wheel and cylinder, against which they are pressed by the steam, and thus turning the wheel and shaft by the expansive force of the steam, without the use of any packing at the afore-mentioned joints, or the application of other power, in the manner herein set forth, or in any other mode substantially the same."

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23. For an *Improvement in Manufacturing Hats;* Francis Degen, City of New York, August 31.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is attaching the former as above described, to a hatter's finishing bench, by means of the frame constructed and arranged in the manner and for the purpose of elevating the former above the bench, to enable the operator to turn the brim with the iron, without moving the hat, as above set forth."

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24. For an *Improvement in Trimming the Heads of Bolts;* Micah Rugg, Southington, Hartford county, Connecticut, August 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the hollow slide or punch, which receives and carries the bolt, in combination with the die for trimming the heads of bolts, as described."

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25. For an *Improvement in Utensils to be used with Cooking Stoves of various kinds;* Salmon C. Riley, City of New York, August 31.

Claim.—"Having thus fully described the use and nature of my improved utensils to be used with cooking stoves of that kind which have oval or elongated openings in their top plates; what I claim therein as new, and desire to secure by letters patent, is the manner of constructing and using the utensil, which I have denominated the *principal piece*, its construction being such as to enable it to receive the respective auxiliary utensils herein described, and to admit of the vapors arising from articles which are being cooked to descend and be carried off with the heated air and gases from the fire, in their passage to the pipe along the flue leading from the fire chamber thereto.

"I also claim the construction and use of the cooking utensils whether used with or without the principal piece, but being furnished with openings, through which the vapors may descend into the flue, below the upper plate of the stove, when they are used for cooking, and a cover is placed over them."

List of American Patents which issued in the month of May, 1847, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Cooking Stoves;* B. Morehouse and W. W. Willard, Syracuse, Onondaga county, New York, May 1.

Claim.—"What I claim as new, and desire to secure by letters pat-

ent, is the arrangement and combination of the side flues, the central return flue, and the flue space in front and at the top of the oven, with the fire chamber, the apertures, the valve, the space, and the discharge flue, substantially in the manner and for the purpose herein set forth."

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2. For an *Improvement in Water Wheels;* Uriah A. Boyden, Boston, Massachusetts, May 1.

The patentee says,—"The nature of my invention consists in causing the stream or streams of water from a water wheel, to diverge gradually, or in causing the water which is ejected from a water wheel, to be diffused gradually, whereby the momentum which the water has on leaving the water wheel, is expended in diminishing the pressure of the water or air on the parts of the wheel which the water last leaves, which is effected by applying a diverging or flaring passage, or passages, the water necessarily passes through after leaving the wheel, which causes the stream, or streams of water to expand, or spread gradually, or to be gradually diffused; and hence, I call this adjunct to the wheel, which I have invented, a *diffuser.*"

Claim.—"What I claim as my invention, and desire to secure by letters patent, is my diffuser as described above, as adapted and applied to all turbines, reacting, and all other water wheels to which the same is applicable, viz: those which receive the water between their peripheries and axis, and discharge the water at their outer or circumferential parts, whether these parts be cylindrical, conical, convex, concave, or of whatever other form. I do not confine my claim to the precise forms of my diffuser described above, but I extend it to all forms which are essentially the same, in which the parts are so shaped as to form a gradually diverging, or spreading passage, or passages, or in which the passage, or passages spread, diverged, or enlarged from the wheel, by degrees, or by small steps, or offsets, so as to cause the stream, or streams of water on or after leaving the wheel, to expand, spread, or be diffused gradually, or by small steps, or degrees, so as to expend a considerable portion of the momentum which the water has on leaving the wheel, in diminishing the pressure of the water, or atmosphere, on the circumference of the wheel, or parts of the wheel, from which the water is ejected."

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3. For an *Improvement in Cast Iron Plates for Covering Buildings;* Matthew Stewart, City of Philadelphia, Pennsylvania, May 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming the rectangular plates with rebated edges on opposite sides, flat on the upper side, or surface, and concave on the under surface, having two of the corners of each plate cut off parallel, causing the plates to combine, and unite, and form close joints, having broad bearings to rest on the sheathing, or laths, and a perforated protuberance, or knob, and a countersink in the same, to admit the shank and head of a screw back of the point of junction of the cut off corners of the plates, so that when a plate is required to be removed, it becomes only necessary to withdraw the screw, and slide the plate

back from beneath the contiguous plates, and it becomes separated therefrom as before described.

"I likewise claim the manner of constructing the triangular shaped plates, having the long sides turned down nearly at right angles to the face of the plate, and notched, and ribbed for the facility of interlocking their ends and securing them together against the gutter; the short sides being rebated in a similar manner to the above named rectangular plates, in order to be fitted under the same, and be combined therewith, as described and represented.

"I also claim constructing the ridge cap, like an angular roof, with a vertical plate projecting down from the apex, and perforated to admit bolts or screws, by which it is secured to the ridge pole—the sloped sides being made sufficiently wide to extend over the adjoining plates on either side of the ridge, as above described and represented."

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4. For an *Improvement in Broiling Apparatus;* Nathaniel Waterman, Boston, Suffolk county, Massachusetts, May 1.

Claim.—"I claim the combination with the double gridiron, or steak holder, of a case made to surround it on all sides but one; the said case being for the purpose of preventing the access of cold air to the back of the meat, or steak, while being cooked."

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5. For an *Improvement in Cheese Shelfs;* Augustus A. Severence, Cherry Valley, Ashtabula county, Ohio, May 1.

The patentee says,—"The nature of my invention consists in providing shelves which revolve upon an axle, and turn upon pivots, or gudgeons, whereby either side of the cheese may be exposed by the dairyman to the air and operation of curing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of shelves with the revolving frame, substantially in the manner and for the purpose set forth."

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6. For an *Improvement in Cooking Stoves;* Elihu Walter, Syracuse, Onondaga county, New York, May 1.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the flues over and under the two ovens; that is, carrying the flue entirely around the oven, (a portion of the said flue being under the fire chamber,) and then dividing the flue around the oven in the manner described, the whole arrangement being as herein set forth."

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7. For an *Improvement in Car Wheels;* William V. Many, Albany, New York, May 1.

The patentee says,—"From the time that the value of railroad wheels with a chilled head and flanch was established, the difficulty of thus casting them has been recognized, for it was soon ascertained that the chill sets and cools the metal of the rim before the parts

which connect it with the hub, and these in cooling shrink, and necessarily break, or become so weak as to break when subjected to strain or jar. To obviate this, the hub was for a long time made in sections, termed the "split hub," to enable it to open and yield to the contraction of the spokes, arms, or other connexions between the hub and rim, but this construction is attended with serious objections, such as the want of strength in the hub, and the necessity of putting on wrought iron hoops or bands, to secure the segments together. These recognized objections to the split hub, have led to numerous improvements and suggestions, all more or less objectionable, for casting the wheel in a single piece by so forming the connexions between the hub and rim as to admit of contraction without breaking; but as all these require the metal, as it contracts, to bend, it obviously must be weakened. The object of my invention is to avoid all these objections to the split hub, and to the various modes which have been substituted therefore, and my invention consists simply in casting the whole wheel in a chill, by means of which all the parts are cooled at the same time, and without undue strain on any part; I am thus enabled to cast a wheel in one single piece, without the split hub, and so connect the rim and hub in any desired form, the plain disk, being in my estimation, the most simple and efficient."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is casting the wheels of railroad cars, or locomotives, with the chilled rim, by chilling the part, or parts, that form the connexion or connexions of the rib and hub, substantially as described, whether both surfaces of the wheel be chilled or only one as described, whereby a better wheel can be cast in one piece than by any other plan with which I am acquainted."

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8. For an *Improvement in Mariner's Compasses;* Hall Colby, Rochester, Monroe county, New York, May 1.

The patentee says,—"The nature of my invention consists in providing duplicate or triplicate needles, arranged on a line on the face of the card of the compass."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement, in a line, of duplicate, or triplicate magnetic needles upon the card of the mariner's compass, by which local, and other influences and attractions are overcome."

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9. For an *Improvement in Window Blinds;* Ebenezer Cate, Boston, Suffolk county, Massachusetts, May 1.

Claim.—"I claim as my invention the pressure, in combination with the folding blind and its frame, as constructed with wide grooves, and made to operate in connexion therewith, substantially as described."

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10. For an *Improvement in Rail Road Wheels;* Perry G. Gardiner, City of New York, May 1.

The patentee says,—"The nature of my invention consists in form-

ing wheels of two corrugated, crimped, or convoluted disks of metal, having exterior convexities united to a rim, or tire, by means of screw bolts drawing inwards their centres, and expanding the peripheries of the disks into grooves in the inner side of the rim."

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming a wheel of two corrugated, crimped, or convoluted disks of metal with outward convexities, combined with a rim, or tire, by means of screw bolts, drawing inwards their centres, and expanding their peripheries into grooves in the rim, substantially in the manner herein set forth."

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11. For an *Improvement in Dressing Staves;* Isaac Judson, New Haven, Connecticut, May 1.

The patentee says,—"The nature of my invention and improvement consists in combining and arranging two revolving rings, or wheels, having cutters on their opposing surfaces, or sides next each other, for shaving the stave transversely on its inner and outer sides, producing a stave, the cross section of which is the segment of a circle; the diameter of which is to be greater than the diameters of the said rings, or wheels, (the curve of the stave being variable at pleasure, according to the sizes of the different kinds of casks for which the staves are intended,) by changing the position of the stationary guides, and feed rolls, and of the cutters on the parallel rings, or wheels, so as to change the angle of the position of the stave with the plane of the rings, or wheels, which forms the base of a right angled triangle, or section of a cone, and the axis of said wheels which forms the perpendicular of said right angled triangle, or the axis of a cone the straight line in which the stave moves towards the cutters, being the hypothenuse of the right angled triangle, or the inclined side of the cone, represented by a line which is made changeable at pleasure, in order to change the degree of curvature of the stave as stated—the angle of the side of the cone with its base being increased, when the degree of the curve of the stave is to be decreased, and when the angle of the cone is diminished, the degree of the curvature of the stave is increased.

"This principle of introducing a stave, or other piece of wood, obliquely betweeen two series of revolving cutters, at any required angle, with the planes of the wheels, or rings carrying the cutters, for the purpose of cutting the stave, or piece of wood transversely to the segment of any given circle corresponding with that of the intended cask, constitutes my principal invention, and improvement.

"The nature of the second improvement consists in a new arrangement of the two movable fluted, or grooved feed rolls, for driving the stave fast, or between the revolving rings, or wheels of cutters, said rolls being held together by a spring, or other means, so as not to give to the stave any specific direction, leaving it to be guided by stationary rests of short lengths, so as to accommodate the crooks and winds of the grain of the wood to the position of the cutters."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"1st. The manner of arranging the wheel and ring of cutters, in parallel planes, forming a space between them for the introduction of the stave, to be dressed simultaneously on both sides—concave on one side, and convex on the other, and to any degree of curvature required, according to the position of the guides in relation to the cutters on the wheel, and ring, as herein set forth,—the stave or other piece of wood being introduced obliquely between the two series of revolving cutters at any required angle with the planes of the wheels, or rings, carrying the cutters, for the purpose of cutting the stave or piece of wood transversely to the segment of any given circle corresponding with that of the intended cask, or barrel, of which the stave is to form a part,—changeable at pleasure by changing the position of the stave,—the feed rollers being made to swing to the right and left in the arc of a circle, for the purpose of accommodating themselves to the irregular shapes of the pieces of wood to be dressed into staves."

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12. For an *Improvement in Bedsteads;* I. H. Latouraudais, Flint Hill, Rappahanock county, Virginia, May 1.

The patentee says,—"The nature of my invention consists in the division and jointing of the mattrass, its combination with the bedstead, and the apparatus for elevating a portion thereof, as herein described."

Claim.—"Having thus described my improved bedstead for the sick, I wish it to be understood that I do not claim making a jointed mattrass, either part of which can be elevated, as that has before been done; but what I do claim as my invention, and desire to secure by letters patent, is so combining the mattrass with the bedstead as to be slid forward to the foot, substantially in the manner and for the purpose described.

"I also claim dividing the lower part of the mattrass longitudinally, as described, so that either part can be elevated, and in combination therewith the frames below these parts.

"Lastly, I claim the presser for elevating the mattrass to the back, as above set forth."

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13. For an *Improvement in an Apparatus for Discharging Grain from Vessels;* John Pagin, Buffalo, Erie county, New York, May 8.

The patentee says,—"The nature of my invention consists in so combining and arranging a conveyor and elevator, with a boat and the driving power, as to elevate the grain from the hold of one vessel, and conveying it and delivering it into another, the elevator being connected with one end of the frame of the conveyor by a vertical slide, that it may descend as the quantity of grain in the hold of the vessel is reduced, and to admit of its being adapted to the various heights of vessels, the connexion with the driving power being made by means of a universal joint and sliding shaft, or other mechanical

equivalents—the other end of the conveyor being jointed to the framing, so as to render the whole apparatus self-adapting to the motions of the vessel, and boat, or scow, produced by swells or other causes."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is so combining a conveyor, and elevator, with a boat, or scow, and the driving power, that the elevator and the end of the conveyor, to which it is attached, can be moved up or down so as to be adjusted to the relative height of the vessel from which the grain is to be elevated, and the boat to which they are attached, and also to the varying height of the grain in the hold of the vessel from which it is to be raised, in the manner substantially as herein described."

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14. For an *Improvement in Ball and Socket Castors;* A. F. Ahrens, Philadelphia, Pennsylvania, May 8.

Claim.—"Having thus fully described my improvement, what I claim as my invention, and desire to secure by letters patent, is supporting the ball of a ball and socket castor, within the socket on points, substantially in the manner and for the purpose described."

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15. For an *Improvement in Dies for Cutting Screws;* Philetus M. Gates, Chicago, Cook county, Illinois, May 8.

The patentee says,—"The object of this improvement is to construct a die in such a manner as that it shall be capable of cutting a full and perfect thread, whether square, or with the sides meeting in an angular edge, at one operation, without the application of more power than is usually expended in each cut of the ordinary dies, which have to be passed several times along the cylindrical piece on which the thread is to be formed. My die is to be made in one piece of cast steel, and usually in the form of a rectangular block, of such diameter as may be necessary, according to the size of the screw to be cut, and of such thickness as may be required by the number of threads that should be formed within it; in most cases it may contain from six to eight threads, but in general six will be found sufficient. Within the hole made through this die for that purpose, a screw is to be cut, in the lathe, or by means of a screw tap. I then proceed to drill two, four, or any preferred number of small holes from one face to the other of the die, their axes coinciding with that of the axis of the large hole constituting the cutting part of the die; these holes are to form a portion of the throat for the receiving and escape of the chips that are to be cut off by the die; they may be from one-fourth to three-fourths of an inch in diameter, more or less, according to the size of the die; supposing the die to be square, they should be drilled towards the angular corners of the block, and their sides should just touch, or be in close contact with the larger diameter of the thread of the screw cut in the die. The portion of the die between these holes and the large hole with cutting theads, are to be filed away in a manner to be presently described. If the threads have been cut up in the lathe, a portion of them may be turned off in such manner as to leave one or

two of the threads that are towards the upper face of the die, perfect, but so that the remaining part shall form a hollow cone, the diameter of which on the opposite or lower face of the die will just obliterate the termination of the last thread; this lower end will then admit the end of the cylindrical piece on which a screw is to be cut; if the screw has been cut by means of a tap, the threads may be reduced by a file. The large hole containing the respective threads will thus increase in diameter, in passing from the upper to the lower face of the dies, and these threads are each to be formed into acute cutting edges, each of which will take off a shaving from the cylindrical piece, instead of in part bruising it into the form of a thread, or of merely scraping a portion away, as is ordinarily done. The parts of the threads not concerned in the cutting are to be further removed by filing."

Claim.—"Having thus fully described the manner in which I construct my dies for the cutting of screws upon metal, and shown the manner in which the same operates, what I claim as new, and desire to secure by letters patent, is the forming of such dies of one solid block, in such manner as that they shall cut a perfect screw by the once passing of it along the piece to be cut; this being effected in the manner set forth: that is to say, by the forming of acute cutting edges on the threads within the die, which threads are to be regulary reduced in height from the upper to the lower face thereof. at which part the last terminating thread is obliterated, and by the filing away of a large portion of threads. The cutting edges being also furnished with throats for the escape of the cuttings, as made known, and the whole apparatus being arranged, combined, and operating substantially in the manner and for the purpose set forth."

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16. For an *Improvement in Carriage Wheels;* Robert W. Thompson, Great Britain, May 8, (patented in England 21st of October 1846.)

The patentee says,—"The nature of my invention consists in the application of elastic bearings around the tires of the wheels of carriages for the purpose of lessening the power required to draw the carriages; rendering their motion easier, and diminishing the noise they make when in motion. I prefer employing for the purpose, a hollow belt composed of some air and water tight material, such as sulphurized caoutchouc or gutta percha, and inflating it with air, whereby the wheels, will in every part of their revolution, present a cushion of air to the ground, or rail, or track, on which they run."

Claim.—"What I claim is, first: the application of elastic bearings round the tire of carriage wheels, as before described; and secondly: the application of similar elastic bearings to the surfaces of other rolling bodies, as before exemplified."

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17. For an *Improvement in Syphons;* Asahel Aldrich, Douglass, Worcester county, Massachusetts, May 8.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of the syphon with a closed receiver, in such

manner as that said receiver shall constitute an enlargement of the syphon at the height to which the tower is to be raised; the lower and shorter legs of the syphon being so proportioned to each other, as that the latter shall be capable of receiving within it a column of air from the closed receiver equal in volume to that which has been drawn therefrom, for the purpose and in the manner described; whilst said longer leg shall still contain a column of water more than sufficient to counterbalance the length of the column in the shorter leg; under which arrangement said column of air is discharged, and the closed receiver refilled preparatory to another intermission of the syphon for the discharge of water therefrom; and in combination therewith, the causing of the water which escapes from the closed receivers, operating by its gravity, to open and close the respective valves at the requisite periods for continuing the action of the apparatus; the whole arrangement and combination being the same in substance with that herein set forth. It is to be understood, however, that I do not intend by the foregoing claim, to limit myself in the construction of this apparatus to the precise form of the respective parts as herein described, but to vary these as I may think proper, whilst the principle of action, and the useful result thereby attained, remain in substance, unchanged."

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18. For an *Improvement in Wringing Clothes;* Ira Avery, Tunkhannock, Wyoming county, Pennsylvania, May 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of each end of the sack to conical heads of equal size by means of rings, for the purpose of enabling the sack to adjust itself perfectly to the heads, thereby preventing unequal strain and rupture of any portion thereof; one of the said conical heads being stationary and the other being connected to an axle, and operating crank, or handle, substantially as herein set forth."

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19. For an *Improvement in Carriages;* John S. Royce, Leicester, Livingston county, New York, May 8.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of stiffening and supporting the felloe of the wheels, securing the same to the tire, and firmly fastening the conical heads of the spokes in the countersinks in the tire by means of the screw nuts (working on screws on the spokes) substantially in the manner herein set forth.

"I also claim the constructing the pipe skeins with loops, on their inner ends, and the connecting the same with the perch, and with the shafts, or pole, substantially in the manner and for the purpose herein set forth."

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20. For an *Improvement in Window Blinds;* Ebenezer Cate, Boston, Suffolk county, Massachusetts, May 8.

The patentee says,—"By my invention the folding shutter is not

only made to answer the purpose of effectually closing the window, and excluding the light, thieves, &c., but may be used, or opened, to admit air, or light, in a manner similar to that in which a Venetian blind is usually opened."

Claim.—"What I claim as my invention is the two hinged chain bearing, and guide plates, in combination with each slat of the blind, having journals as described, the said plates being conjoined and made to move in grooves in the window frame, and applied to the slat, and operated in all respects substantially as specified."

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21. For an *Improvement in Lynch Pins, and Washers;* Warren Mansfield, South Braintree, Massachusetts; and H. L. Thistle, City of Washington, D. C., May 8.

Claim.—"What we claim as new, and desire to secure by letters patent, is the attaching of the washer and lynch pin, by means of a chain, to a swivelling ring on the hub of the wheel, the attachment being made in the manner set forth, so that for the removal of the lynch pin, said washer will have to be turned round in the manner described, the whole combination and arrangement being substantially the same with that herein fully made known."

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22. For an *Improvement in the Manufacture of Cigars;* Samuel E. Hartwell, and W. M. and Dégrasse Fowler, of the City of New York, May 8.

The patentees say,—"The nature of our invention consists in forming the filling of cigars, and covering them with a wrapper by machinery, by which the process is facilitated, and greater perfection is attained in forming the cigar, while fine cut, or other tobacco, can be used for the fillers without waste."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of a flexible apron, substantially in the manner described, for rolling the fillers of cigars into form, and covering them with the wrapper as herein set forth.

"We also claim forming the edges of said belt of elastic material, for shaping the taper at the ends of cigars.

"We also claim the employment of the roller and weight with the apron for maintaining the tension of the apron, and determining the pressure upon the cigar.

"We also claim, in combination with the above, the movable trough, formed of a series of belts, for receiving the filling, and carrying it forward as above specified, and the cutter and follower for cutting off the cigar, and carrying it into the bight of the apron as herein described."

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23. For an *Improvement in the Scarificator;* Frederick Leypoldt, City of Philadelphia, Pennsylvania, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the tumbler, and main spring,

substantially as herein described; the main spring having a ketch, and the tumbler a shoulder, or step, and pin; these parts being ar ranged, and operating in the manner and for the purposes described."

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24. For an *Improvement in Rail Road Wheels;* Anson Atwood, Rensselaar county, New York, May 15.

The patentee says,—"The object of my invention is to cast a wheel in one piece with a solid hub, without subjecting the parts to the liability of breaking; and the nature of my improvement for this purpose, consists in connecting the rim with a ring whose faces are made in radial waves, passing around by a series of curves from one edge of the rim to the other entirely around, to give a continuous support to the whole width of the rim, and chiefly to yield without strain on the metal, to the contraction of the ring which cools after the rim; this mode of connecting the rim and ring, being combined with a solid hub, by means of a dished flanch, or flanches, which admit of yielding to the contraction of the metal in the direction of the radii."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is connecting the rim of the wheel cast in one piece with a solid hub, by the combination of a ring made of radial waves, in combination with the dished flanch, or flanches of the hub, which form a rim concentric with the rim of the wheel, substantially as described; whereby the several parts can yield to the unequal contraction in all directions without serious strain of the metal as described."

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25. For an *Improvement in Stoves;* Garrettson Smith, and Henry Brown, Philadelphia, Pennsylvania, May 15.

The patentees say,—"The nature of this invention consists in placing in the fire chamber immediately in front of the oven, a series of inclined ribbed flue plates, composed of cast iron, or other suitable material, for the purpose of directing the draught in any direction required, and preventing the lower flues from being obstructed by ashes, or other particles, arising from the fire."

Claim.—"What we claim as new, and desire to secure by letters patent, is the flue plates, and cylinder, constructed substantially as described."

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26. For an *Improvement in Hot Air Furnaces;* David Culver, Hartford, Hartford county, Connecticut, May 15.

The patentee says,—"The object of my invention is to obtain a large radiating surface, with the view to get the greatest amount of heat with a given amount of fuel, and so to arrange the parts that the inside may be kept clear of soot and ashes during the operation of the furnace; and the nature of my invention consists in making the drum, placed immediately over the fire, in the form of an hour glass, surrounded with a series of pipes, the lower ends of which open into a chamber, formed by an inverted hollow frustrum of a cone that forms

the connexion between the fire pot and the drum, and their upper ends opening into a dome that extends over them and the drum. And my invention consists, also, in a disk valve, or swinging partition in the smallest part of the drum, the valve being properly balanced and hung on journals, and provided with a weight attached vertically to its underside, to act like a pendulum, or provided with any other means by which to keep it closed, except when vibrated, to discharge the soot and ashes which may accumulate on its upper surface. By this arrangement of parts, the products of combustion in rising from the fire pot, impinge on the curved surface of the drum, (which, as stated above, is formed like an hour glass, to present a large surface,) and against the valve, (which is kept closed by the pendulous weight,) and finding no escape they are deflected, and pass up the vertical pipes into the upper part of the drum, and dome, which they heat, depositing the soot and ashes on to the valve, or swinging partition, and then pass through a horizontal pipe into one division of a flat radiator down to the base thereof, and thence up the other division, and out into the exit pipe, the arrangement of this flat radiator, in combination with the circular radiator, constituting the third part of my invention. And the last part of my invention consists in uniting the horizontal and escape pipe with the top of the flat radiator, by means of a globe or sphere, in combination with a round disk valve, by means of which spherical enlargement and disk valve, the aperture for the passage of the products of combustion, is always of the full capacity of the pipe."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the drum which is placed over the fire pot, in the form of an hour glass, to present a large amount of surface to the action of the flame, and for radiation, as described, when this is combined with the vertical pipes surrounding the drum as described.

"I claim the employment of the disk valve, or swinging partition within a vertical drum, placed over the fire for the discharge of soot and ashes from the compartment above the swinging partition, as described.

"And finally, I claim the globe-formed enlargement at the junction of the pipes, and the flat radiator, in combination with the circular disk valve, or damper, by means of which enlargement, in combination, the apertures for the passage of smoke, &c., are retained of their full capacity."

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27. For an *Improvement in Ship's Windlasses;* Albert Russell, and E. R. Walker, Newburyport, Essex county, Massachusetts, May 15.

The patentees say,—"We are well aware that a nipper purchase and a pall purchase, have been used separately on windlasses, therefore we make no claim to them when used separately, but that which we *claim* as our invention, is the *combination* of the nipper and pall purchases, in the manner substantially as specified."

28. For an *Improvement in Hand Drills;* Amos Morgan, Masselon, Stark county, Ohio, May 15.

The patentee says,—"The nature of my invention consists in constructing a cheap hand drill for iron and other metals, so as to be made self feeding, and at the same time being readily fed by hand without stopping the other feed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the mandril with the feeding apparatus, in the manner described, by means of the hollow screw, and case, surrounding the mandril, connected with the ratchet, and dog, substantially in the manner set forth."

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29. For an *Improvement in Bedstead Fastenings;* J. W. Moyer, Utica, Oneida county, New York, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of fastening bedsteads above described, in making the back face of the spurs which secure the tenons in their mortises, partly diagonal, and partly parallel with the front face thereof, and the shoulder of the tenons, substantially as described, when this is combined with the grooves in the sides of the mortise, and the sockets formed by, and for the reception of the spurs, as described; whereby the rails and posts of square tenon bedsteads can be fastened at less expense, and held together more firmly than by any other plan known to me."

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30. For an *Improvement in Furnaces for Heating Buildings;* Wm. Hickok, City of New York, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the vaporizer with the air heater, constructed, and operated in the manner and for the purpose set forth."

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31. For an *Improvement in Rakes;* Charles Carlisle, Norwich, Windsor county, Vermont, May 15.

Claim.—"What I claim as my invention is the combination of a balance box, or weight, with the shafts and axletree, for the purpose described. I also claim the mode of supporting the rake head and confining it to the axletree, viz: by the springs and jointed rods acting substantially in manner and for the objects specified."

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32. For an *Improvement in Suspender Buckles;* Julius Hotchkiss, Waterbury, New Haven county, Connecticut, May 15, (antedated, Dec. 22, 1846.)

The patentee says,—"The nature of my invention consists in attaching with an eyelet, or rivet, a leather loop to a suspender buckle, and particularly the manner of its connexion, so as to form a joint,

or swivel, operating in its use and application, conformable to the particular wants of such an article."

Claim.—"I claim securing the leather strap, or loop, to the suspender buckle, in the manner described, by means of the eyelet, or rivet, whereby I obtain a durable and cheap mode of fastening, at the same time with a durable and serviceable swivel joint."

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33. For an *Improvement in Dentists' Drill;* John and Dayton S. Kellogg, assignees of L. D. Walter, Fort Plain, Montgomery county, New York, May 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the main spring, pulley, and cord, with the drill, for the purpose of drilling, countersinking, trepanning, &c., substantially as described."

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34. For an *Improvement in Smut Machines;* James E. Wratten, Rush, Monroe county, New York, May 15.

Claim.—"What I particularly claim as my invention, is the mode of making the rubber, substantially as above described—that is to say, covering the external convex surface of the frustrum of a cone with sheet iron rings, of trapezoidal shaped teeth, combined and arranged, and operating in the manner and for the purpose set forth."

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35. For an *Improvement in Spark Extinguishers;* Samuel Gibson, Manayunk, Philadelphia county, Pennsylvania, May 22.

The patentee says,—"The operation of the machine is as follows: When the engine is set in motion, the steam, by acting on the fans at the bottom of the inner pipe, gives a rapid revolving motion to the shaft carrying the inner pipe, and then passing with the smoke, &c. into the spiral flue formed by the inner pipe, and spiral planes, keeps up and increases that motion issuing out of the top of the inner pipe, from whence the smoke and cinders are thrown with violence against the inside of the outer pipe, or its cap, and then falling down on the partition plate, are discharged by the oblique pipe downwards upon the road. When the apparatus is not in operation, the smoke is discharged by a pipe of the ordinary construction, made to open and close with a valve at the bottom of it, placed behind the triple pipe, or spark catcher; the valve is managed by a crank and rod, passing to the hand of the engineer."

Claim.—"What I claim as my invention, is the combination of the triple pipe, and the revolving screw, and in combination therewith, the oblique partition plate, and discharge pipe."

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36. For an *Improvement in Door Springs;* Thomas Peck, Syracuse, Onondaga county, New York, May 22.

Claim.—"What I claim as new, and desire to secure by letters patent, is the spring, the roller, and the cam, on the periphery of the

drum, combined and operating with each other, and with the spring, lever, and roller, substantially in the manner and for the purpose herein set forth."

37. For an *Improvement in Cooking Stoves;* Ashley Crafts, Auburn, Geauga county, Ohio, May 22.

The patentee says,—"The nature of my invention consists in constructing a stove which can be used as a small cooking stove. If a larger one is required, the stove part may be drawn out from under the oven, which gives two additional boiler holes. If a fire place or open stove is desired, it is effected by running the stove part under the oven, and raising the jambs to their elevated position."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st. Making the stove sides continuous with the hearth and flue plates, both top and bottom, in combination with the sliding jambs, which keeps all fire or ashes from dropping through when the jambs slide up or down outside of them.

"2d. The method by which the jambs, and front, top, and other plates of the stove are fastened together, which is by four loops, two of which are cast on each end of the top, and the two pins which are cast on to each jamb, all on the inner and under side of each piece. The pins lock into the loops and make all fast without the use of bolts or rods.

3d. The manner of using the lever in combination with the movable jambs, by which the stove is changed from a cook stove to a fire place.

4th. Arrangement in the front oven plate of an aperture or chimney flue, which flue constitutes the draft when it is used as a fire place.

5th. The moving the stove back to bring the back side of the front top to meet the chimney flue in the front oven plate, when raised into a fire place."

38. For an *Improvement in Car Wheels;* Asa Whitney, Philadelphia, Pennsylvania, May 22.

The patentee says,—"The design of my improvement is to give a greater degree of elasticity, than has heretofore been given, to the wheels used on rail roads, and to provide more perfectly for their ready expansion and contraction in virtue of such elasticity; and that whether said wheels are made entirely of cast iron, or of a combination of cast and wrought iron, or other metal, my improved wheels are of the kind in which the space between the rim, and the hub, or nave, consists of a disk, or disks, instead of the spokes that have been most generally employed. These disks I make corrugated in such manner as that a vertical section cutting them through their centres, and also a like division of them into circles at any point between their rims and naves, would present waved, curved, or sinuous lines, which may be either of continuous curves, or of straight lines and angles,—said wheels being corrugated in one or more forms, or in any form in which both the transverse and circular sections above named

would produce such sinuous, or waved lines. I am aware that car wheels have been made with disks that were concavo-convex, both double and single, and that they have also been made with disks, the transverse section of which, from the rim to the hub, would present a waved line, consisting of two or more curves; but neither of these forms fulfil the condition of allowing a free expansion and contraction in all directions, resulting from the elasticity consequent on the manner of corrugating them."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the corrugating of the disks of rail road wheels in such manner as that they are rendered elastic and flexible, and are susceptible of expansion and contraction, by the yielding of the corrugated parts, both in diameter and circumference simultaneously."

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39. For an *Improvement in Cast Iron Car Wheels;* Asa Whitney, Philadelphia, Pennsylvania, May 22.

The patentee says,—"The design of my improvement is to give a greater degree of strength, with a less amount of material, than has heretofore been given to the wheels used on rail roads, which is accomplished by making the disk, or that part of the wheel between the rim, or hub, or nave, corrugated in radii from the centre, so that a vertical section around the centre, at any point between the rim and hub, will show a waving, or wrinkled line, which may be either in continuous curves, or in straight lines and angles, while a vertical section across the wheel through its centre, would present a straight line on the disk."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner set forth of corrugating the disks of rail road wheels, by which they can be made stronger and more durable with a less amount of material, than any other form of disk, or spoke wheels, as heretofore made."

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40. For an *Improvement in Making Brick;* Alfred Hall, Coxsackie, Green county, New York, May 22.

The patentee says,—"The nature of my invention consists in a peculiar construction of machinery, to be worked by hand and horse power, for producing in an expeditious and efficient manner, bricks, tiles, and other articles from earthy or plastic materials. The moulding machine I propose to place in direct communication with the pug mill, in order to keep up a regular and continuous supply of clay to the moulds."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the press with the pug mill, as above set forth, so that while the clay is being pressed into the mould, it shall, at all times, have a free opening into the mill, by which much of the danger of breaking the parts is avoided. I also claim the curved railway in combination with the movable carriage for forcing in the moulds, so that said carriage shall have its front at the same level at all times.

"Lastly, I claim the method of constructing the press so that the side plates do not require to be made with a slot in them, by carrying the shaft that connects the press with the segments back, so as to be free to act as herein specified, without passing below the point the press plate moves back to."

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41. For an *Improvement in Steam Engine Valves;* Jas. A. Stevens, (assignee of Sprague Barber,) Hoboken, New Jersey, May 22.

The patentee says,—"The object of this invention is to construct a less expensive and more perfect apparatus, for closing the steam valves at different portions of the stroke of the piston, and thereby cutting off the steam from the boiler, and allowing it to act expansively in the cylinder. This I mean to accomplish by what I call a drop slide, this drop slide elevates the valve to its required height with the original lifting rod, by means of its shoulder, and then the shoulder being withdrawn by an attachment to some suitable portion of the machinery, allows the valve to drop with any degree of velocity that may be found necessary on the curve of the drop slide."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method herein described, of connecting the lifter of the valve with, and disconnecting it from the lifter of the lifting rod, by means of the drop slide, in combination with the lifting rod and lifter attached to the valve, the drop slide being operated during the lifting of the valve, substantially as described; and I also claim the method of arresting the downward motion of the valve, by the inclined or curved face of the slide that holds and liberates the valve, whether it be the slide herein ascribed, or any thing analogous, or equivalent thereto, as described."

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42. For an *Improvement in Ploughs, or Cultivators;* Richard J. Gatling, Murfreesboro, Hartford county, North Carolina, May 29.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is,—1st. Making the cultivator with adjustable sliding wings of a rhomboidal form in their cross sections, arranged and operating in the manner and for the purpose described. 2d. Extending the rear or wide portions of the double share back, in the form of two flat curved wings, forming the curved spaces, and to which the side bars or braces are attached, and upon which the adjustable wings or mould boards are placed in the manner and for the purpose set forth.

"3d. Making the point in the form of a double wedge with wings, or shoulders, to fit into corresponding mortises in the share for securing the same—being reversible at pleasure as the point wears, susceptible of four changes."

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43. For an *Improvement in the Reduction of Iron Ores;* William S. Cooke, East Fairfield, Columbiana county, Ohio, May 29.

The patentee says,—"The nature of my invention consists in using steam in the form of a blast, for the purpose of softening iron, by in-

troducing a jet of steam into a cupola, or furnace of the proper temperature, (about 300° deg.,) either with or without air, depending on the kind of fuel used; the oxygen is absorbed by the fuel and supports combustion, and the hydrogen passes over the heated metal, the carbon of the metal unites with it, and is burnt in the form of carburetted hydrogen gas—by this process, hard brittle metal can be reduced to a soft malleable state even without melting; if the casting is too brittle, the steam may be thrown on it while heated to a white heat, and it will have the desired effect."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use and utility of using steam in the form of a blast, for the purpose of softening metallic ores while in the process of reduction (or changing form by smelting) as herein described."

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44. For an *Improvement in Grain Rakes;* John M. and B. B. Brown, Marits P. O., Marion county, Ohio, May 29.

The patentees say,—"What we claim as our invention and desire to secure by letters patent, are the combinations of the divider (operating as set forth) with the small frame in the manner described, also the sharp edges of the fore part of the fingers, by means of which the small vines and grass in the stubble are cut and prevented from obstructing the progress of the rake."

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45. For an *Improvement in Distilling;* George Riley, City of New York, May 29.

The patentee says,—"The nature of my invention consists in causing the 'wash' or other article to be distilled, to percolate down through a vessel filled with porous material, meeting an ascending current of steam by which all the volatile spirits are released and pass off through the worm of the still, the wash being made to constantly run off below."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is distilling alcohols and other volatile spirits, by causing a current of steam to pass up through a vessel filled with stones or other substance, as above mentioned, through which the wash or other material is percolating—the apparatus therefor being constructed substantially in the manner described."

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46. For an *Improvement in Jointing Staves;* A. H. Pinney, Columbus, Franklin county, Ohio, May 29.

The patentee says,—"The nature of my invention consists in the frame for applying a bent stave to two revolving planing wheels so as to joint both edges of the stave before it leaves the frame, and the apparatus for springing in and releasing the stave therefrom."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of an apparatus for applying the stave to the rotary jointing wheels, substantially in the manner and for the purpose set forth, so that the staves can be easily handled be-

yond the periphery of the wheels, and thrown accurately into place against them, as above specified.

"I also claim, in combination therewith, the manner of holding the block and springing in the stave as herein specified."

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47. For an *Improvement in Cotton Presses;* Riley Smith, Towanda, Bradford county, Pennsylvania, May 29

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of arranging and combining the weights with each other and with the levers, so as to cause said weights to co-operate in sustaining the levers and to cause their joint action when required, as set forth."

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48. For an *Improvement in Distilling;* William H. Bayless, City of New York, May 29.

The patentee says,—"The nature of my invention consists in forming and arranging the vessels or receivers, designed to contain the article to be evaporated, distilled, or condensed, so that the heat of the steam or vapor arising from a boiler, arranged in the common furnace, shall be made to act against the bottom or sides of a vessel composed of some good conductor of heat, such as copper, containing a liquid or other solution to be evaporated or distilled—the heat of the vapor or steam arising from said liquid in said vessel, being in turn made to act against the bottom or sides of a second similar vessel, containing a similar liquid, or solution; and so on to any required number of vessels, placed or arranged, one above another, or in any convenient way, in a tight case, or room, or other suitable structure, made of an oblong or round, or other figure, or shape, of some good non-conducting material, such as brick, or wood, a communication being opened from one vessel to another throughout the whole series, by means of vertical pipes, open at both ends, passing through the bottoms of said vessels, the upper ends of said pipes or tubes, being a little below the upper edges, or the level of the tops of the vessels, or evaporators, so that when the upper vessel is filled nearly to the top level (which is effected by the pipe leading from the vessel or reservoir containing the article to be evaporated), the liquid will commence running from the top vessel into the next below it, and so on, passing through the several connecting pipes, until all the vessels and boilers are filled to the required levels at which they are kept, by keeping up this supply through the pipe; the bottoms of the several evaporators being made inclining at any suitable angle, for the purpose of discharging the condensed vapor into suitable receivers placed below them, provided with suitable pipes, passing through the walls of the case for conveying the condensed vapor wherever desired."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described mode of evaporating and distilling by means of a series of vessels so formed and arranged in a non-conducting structure as to transmit the heat arising from the vapor or steam of a common boiler to the under surface or sides, of a

series of boilers in succession, by which the heat, which is usually lost, is made to produce a repetition of the evaporating operation to the bottom or sides of an extra number of boilers to any degree required, by which a great saving in the cost of fuel is effected in the process of evaporation or distillation, the steam or vapor being condensed and collected in vessels in the interior of the external non-conducting case, as fully shown in the specification."

MECHANICS, PHYSICS, AND CHEMISTRY.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines. By M. V. Regnault.

FOURTH MEMOIR.

(Continued from page 55.)

PART SECOND. *Of the Mercurial Thermometer.*

"The mercurial thermometer not being a comparable instrument beyond the temperatures which have served to determine the fixed points of its scale, it is evident that it ought not to be employed in precise experiments to measure high temperatures, but that recourse ought to be had to the air thermometer. But the employment of this latter instrument is much more difficult; it requires very delicate manipulations, and circumstances may present themselves in which the air thermometer is completely inapplicable, as, for example, when it is necessary to determine the temperatures in very confined spaces; the mercurial thermometer must then necessarily be used, but it will be proper, in the first place, to make a direct comparison of this instrument with an air thermometer, so as to transform its indications into those of the standard thermometer."

"Dulong and Petit were the first who made a comparison of the air with the mercurial thermometer from —36° to + 360° (33° to + 680° Fahr.,) and they calculated a table by which the indications of the one can be transformed into those of the other."

But the table of Dulong and Petit is necessarily inexact even for the particular mercurial thermometers which they employed, since their experiments were calculated with a coefficient of dilatation of air, much too great. M. Regnault also made a great number of experiments upon this subject—*(Annales de Chimie et de Physique, 3^e serie, tome V., p.* 83,*)* and in the course of these experiments, he found that mercurial thermometers were not comparable, so that the table published in his memoir, applies only to the particular thermometers which he employed. M. Magnus also investigated the same subject nearly at the same time. *(Annales de Chimie, 3^e serie, tom. VI., p.* 353.*)* The numbers which he gives, differ from those of M. Regnault, which ought not to surprise us, since the glasses used by the two experimenters, were of very different composition. (See note to M. Magnus' memoir, *Annales de Chimie, tom. VI., p.* 370.) But since the cause of these differences is evidently the different dilata-

tions of specimens of glass varying in composition, it remains yet to be seen whether mercurial thermometers constructed with the same kind of glass, although made in different ways, would not accord sufficiently in their movements to allow them to be considered as comparable. If this be the fact, it will be enough to compare one of these thermometers once for all with the air thermometer, and to admit the same table of corrections for all similar instruments. It was in order to decide this question, that M. Regnault undertook the series of experiments recorded in this part of his memoir; which experiments, he extended not only to the comparisons with the air thermometer, of thermometers made of the same kind of glass differently worked, but also to a similar study of instruments made of all the various kinds of glass found in the commerce of France, and used in the formation of physical apparatus. By this means he put himself in possession of a table of cubic dilatations of various kinds of glass at different temperatures, which table was absolutely necessary in his experiments, for the purpose of rigorously correcting the air thermometers for the dilatation of their envelopes, and which we insert in this brief digest, in consequence of its importance in many physical investigations.

The mercurial thermometers used by M. Regnault in these experiments, were not of the ordinary construction, but were overflow thermometers, *(thermomètres à déversement,)* which are more easily constructed than the ordinary thermometers with graduated stems, and present, moreover, the very great advantage of permitting the whole mercurial column to be easily kept in the bath whose temperature is to be noted, while with the common thermometer, a notable portion of the stem rises above the heated bath, and must be allowed for by a correction, the elements of which are always very uncertain.

Overflow thermometers consist of reservoirs of glass, terminated by capillary stems, drawn out at their extremities, and recurved. The mercury in these instruments is boiled frequently and with great care, and the instrument is then immersed in ice with its beak plunged into a vessel of mercury. When the thermometer has taken exactly the temperature of 0°, (which is easily determined, because if the capsule be removed, the mercurial column remains stationary at the mouth of the capillary tube,) the ice is removed, and the mercury which is discharged by the elevation of temperature, is collected in a small capsule. This is then weighed together with the apparatus filled with mercury; and if from the sum of these weights, we subtract the weight of the empty thermometer, we shall have the weight of mercury which fills the apparatus at 0°. Call this weight, P.

Now expose the apparatus to the temperature of boiling water, (which temperature may be determined from the height of the barometer at the time, by the use of the table given by M. Regnault, *(Annales de Chimie et de Physique, 3e serie, tome IV., p. 206,)* or the proper precautions may be used to make it exactly 100°. Call this temperature θ, and let the weight of mercury discharged between 0° and θ be called π. Whenever the same instrument, after refilling, is carried to any unknown temperature t, the weight of mercury discharged

being p; this temperature will be given *in degrees centigrade,* by the formula $$t=\theta \frac{P}{\pi} \frac{P-\pi}{P-p}.$$

Or since θ, P, and π are constants for the same instrument, calling $\theta \frac{P-\pi}{\pi}=A$ we shall have the formula $t=A\frac{P}{P-p}$.

And M. Regnault proceeds to demonstrate that this temperature will be the same as that shown under the same circumstances by an ordinary mercurial thermometer, with graduated stem, whose envelope is formed of the same material, and by the same mode of working, as that of the overflow thermometer.

The first experiments upon this subject by M. Regnault, were made upon thermometers made in different ways from the crystal glass of Choisy le Roi. This glass is made of extremely pure materials, the proportions of which are determined with extreme care; it presents, therefore, the same composition, and is very valuable for experimental purposes on this account.

The first thermometer of this glass had its reservoir formed of a tube of 14 mm. interior diameter; and the stem was made of a capillary tube of the same glass welded upon the reservoir.

The second thermometer had a spherical reservoir obtained by blowing from a capillary tube.

The third thermometer was formed from the same capillary tube as No. 2, which was worked in the lamp so as to form a cylindrical reservoir, of about 12 mm. diameter, and from 12 to 14 cm. in height. To obtain this the glass had to be submitted a number of times to the flame, and it was therefore well fitted to show whether a long working of the glass had any influence upon the law of its dilatation.

A fourth thermometer had a reservoir made of a small globe of 50 mm. in external diameter, the walls of which were from 3 to 4 mm. in thickness, it was used to study the effect which different thicknesses of glass would have on the results.

The analyses of the reservoirs of these thermometers by M. Salvetat, a young chemist, attached to the royal manufactory of porcelain at Sevres, gave the following results:

	Silica.	Alumina.	Oxide Iron.	Oxide Manganese.	Lime.	Potassa.	Soda.	Oxide Lead.
No. 1, Mean of 3 experiments.	54·16	0·52	trace	trace	0·36	9·23	0·90	34·62
" 2, " 5 "	53·83	0·49	0·24	0·24	0·78	7·98	2·54	34·08
" 3, " 5 "	54·39	0·43	0·33	0·19	0·69	7·80	2·40	33·70
" 4, " "	53·33	0·48	trace	trace	0·40	9·16	0·95	35·38

The result of these experiments was to shew that although the coefficients of dilatation of these different glasses differed notably, as will be seen by the following table:

Dilatation of the glass of No. 1, from 0° to 100°=0·002144
" " " " 2, " " 0·002442
" " " " 3, " " 0·002328
" " " " 4, " " 0·002270

yet, that the law of the increment of the dilatation was the same within the limit of errors of observation; whence we may conclude that the same corrections may be applied to reduce the indications of any thermometers made of this kind of glass to those of the air thermometer.

M. Regnault then proceeds to give his experiments upon thermometers made of other kinds of glass, viz: various specimens of common glass, the green glass of difficult fusibility used in chemical experiments, and a specimen of Swedish glass possessing the same physical characters. The analyses of these glasses gave the following results:

Thermometer.	Density	Silica.	Alumina.	Oxide Iron.	Oxide Manganese.	Lime.	Magnesia.	Potassa	Soda.	Oxide Lead.
No. 5, Common glass	2·455	70·48	0·46	0·28	0·19	8·75	0	2·14	17·20	0
6, " "	2·452	69 75	0 75	0·67	0 50	8·59	trace	2·60	16·30	0
7, " "	2 606	70 95	1·00	2·00	1·00	5·74	trace	5 67	10·41	3·16
8, " "	2·449	72 56	1·95	trace	trace	7·26	trace	2·97	14·86	0
9, " "	2·447	72 31	0 96	0·29	trace	5·88	0	4·18	15·29	0
10, Chemical "	2·481	68·58	1·23	1 84	0·46	4·07	0	2 00	12·00	0
11, Swedish "	2·410	71·37	0·33	trace	trace	9·36	trace	17·23	1·79	0

The thermometer No. 5, was formed from a tube of 12 or 14 mm. interior diameter, and ¾ mm. thickness.

No. 6, of a tube similar to No. 5, but of about double the thickness.

No. 7, of a small globe welded to a capillary stem of the same material.

Nos. 8, and 9, of bulbs blown upon capillary stems in the ordinary way.

No. 10, of a tube similar to those used for organic analysis, soldered to a capillary stem of the same.

No. 11, of a similar tube, brought by M. Pelouze from Sweden in 1840, and remarkable for its infusibility.

The dilatations of these glasses from 0° to 100° were as follows:

No. 5, 0·002713. No. 7, 0·002431. No. 9, 0·002758. No. 11, 0·002492.
" 6, 0·002686. " 8, 0·002619. " 10, 0·002324.

Besides these experiments, the memoir contains the corrected results of other experiments of the author made in 1841, and reported in the *Annales de Chimie et de Physique, 3ᵉ serie, tome V., p.* 83, (which required correction, owing to the new determination of the absolute dilatation of mercury,) as well as a series of comparisons between the mercurial and air thermometers in the vapors of boiling oil of turpentine and of mercury.

The general conclusions from all these experiments, we give in the words of the author:

" *Mercurial thermometers made of the different kinds of common glass, which are now ordinarily used in the manufacture of chemical implements, do not move rigorously together beyond the fixed points which have served to regulate their scales; but the differences are so small, that they may be neglected in the greater number of experiments, especially if we take care to reject those glasses which contain a perceptible quantity of oxide of lead, which are easily recognized while working them in the lamp.*"

"*Mercurial thermometers of ordinary glass, differ considerably in their indications from those whose envelope is of crystal; and these two classes of instruments cannot be considered as comparable.*"

"*In all cases, it is necessary to transform the indications of mercurial thermometers into those of the air thermometers, by means of the tables which we give farther on.*"

"I inquired whether the absolute dilatations (k_t) of the same glass envelope, and the apparent dilatations ($\triangle_t$) of the mercury in this envelope, could be connected with the temperatures (T) given by the air thermometer, with sufficient exactness, by parabolic formulæ of two terms; $k_t = bT + cT^2$. $\triangle_t = b'T + c'T^2$. But I found that these formulæ did not represent the observations in a satisfactory manner. When, therefore, it is necessary to know with great accuracy the values of these dilatations, it is better to deduce them by graphic constructions made from the immediate data of experiments, or to calculate formulæ of interpolation with one term more; but in this latter case, it will be better to seek for a form of interpolation which applies more exactly to the nature of the phenomenon than the parabolic."

"Yet this (the parabolic) method of interpolation suffices, when it is proposed only to calculate the tables of the dilatation of glass, which are necessary for the correction of air thermometers for the dilatation of their envelopes. In this way I have constructed the following table, which applies to the only two kinds of glass which were employed in the construction of my air thermometers, viz: the crystal of Choisy le Roi, and common tube glass."

"The constants of the parabolic formulæ are—

For the crystal, $a=0$. Log: $b=$ —4,1957769. Log: $c=$ —8,258066.

" com. glass, $a'=0$. Log: $b'=$ —5,4171928. Log: $c'=$ —8,1691500."

Table of the Dilatations of Crystal and Common Glass.

Temperature by Air Thermometer.		Crystal.		Common glass.	
Fah.	Cent. (T)	Dilatation from 0° to T°. (k_T)	Mean coefficient of dilatation from 0° to T°. (k.)	Dilatation from 0° to T°. (k_T)	Mean coefficient of dilatation from 0° to T°. (k)
50°	10°	0·000227	0·0000227	0·0002628	0·00002628
68	20	0·000454	0·0000227	0·0005285	0·00002642
86	30	0 000681	0·0000227	0·0007973	0·00002658
104	40	0·000909	0·0000227	0·0010689	0·00002672
122	50	0·001137	0·0000227	0·0013435	0·00002687
140	60	0·001368	0·0000228	0·0016211	0·00002702
158	70	0·001594	0·0000228	0·0019016	0·00002717
176	80	0·001825	0·0000228	0·0021851	0·00002731
194	90	0·002054	0·0000228	0·0024716	0·00002746
212	100	0·002284	0·0000228	0·0027609	0·00002761
230	110	0·002516	0·0000229	0·0030532	0·00002776
248	120	0·002747	0·0000229	0·0033486	0·00002790
266	130	0·002980	0 0000229	0·0036468	0·00002805
284	140	0·003212	0·0000229	0·0039479	0·00002820
302	150	0·003445	0·0000230	0 0042525	0·00002835
320	160	0·003678	0·0000230	0·0045600	0·00002850
338	170	0·003912	0 0000230	0·0048705	0·00002865
356	180	0·004146	0·0000230	0·0051822	0·00002879
374	190	0·004380	0·0000230	0 0054967	0·00002893
392	200	0·004616	0·0000231	0 0058171	0·00002908
410	210	0·004851	0·0000231	0·0061383	0 00002923
428	220	0·005088	0·0000231	0·0064636	0·00002938
446	230	0·005325	0·0000231	0·0067919	0·00002953
464	240	0·005561	0·0000232	0·0071232	0 00002968
482	250	0 005799	0·0000232	0·0074559	0·00002982
500	260	0·006037	0·0000232	0 0077922	0·00002997
518	270	0·006275	0·0000232	0·0081324	0.00003012
536	280	0·006514	0·0000233	0·0084756	0·00003027
554	290	0 006753	00·000233	0·0088218	0·00003042
572	300	0 006994	0·0000233	0·0091686	0·00003056
590	310	0·007234	0·0000233	0·0095201	0·00003071
608	320	0·007474	0·0000233	0·0098752	0·00003086
626	330	0·007716	0·0000234	0·0102333	0·00003101
644	340	0·007958	0·0000234	0·0105944	0·00003116
662	350	0·008199	0·0000234	0·0109585	0·00003131

"I will terminate this second part of my work by giving a general table, which includes all the results of the comparison of the normal air thermometer, with the different kinds of mercurial thermometers which I have studied. These results are deduced from graphic constructions executed with much care from the immediate data of experiment. The table commences at 100°, which is the last fixed point at which the thermometers necessarily agree. It is, however, probable, that there exists a sensible difference between 0° and 100° in the movements of those different instruments. Certain series of experiments show it clearly; but the differences are so small that it is difficult to determine them with any precision."

Table of the Comparison of Air and Mercurial Thermometers.

Temperatures by the Air Thermometer.		Centigrade Temperatures by the Mercurial Thermometers.			
Fahr.	Cent.	Crystal.	Common glass No. 5.	Green glass No. 10.	Swedish glass No. 11.
212°	100°	100·00°	100·00°	100·00°	100·00°
230	110	110·05	109·98	110·03	110 02
248	120	120·12	119·95	120·08	120·04
266	130	130·20	129·91	130·14	130·07
284	140	140·29	139·85	140·21	140·11
302	150	150·40	149·80	150·30	150·15
320	160	160·52	159·74	160·40	160·20
338	170	170·65	169·68	170·50	170·26
356	180	180·80	179·63	180·60	180·33
374	190	191·01	189·65	190·70	190·41
392	200	201·25	199·70	200·80	200·50
410	210	211·53	209·75	211·00	210·61
428	220	221·82	219·80	221·20	220·75
446	230	232·16	229·85	231·42	230·90
464	240	242·55	239·90	241·60	241·16
482	250	253·00	250·05	251·85	251·44
500	260	263.44	260·20	262·15	
518	270	273·90	270·38	272·50	
536	280	284·48	280·52	282·85	
554	290	295·10	290·80	293·30	
572	300	305·72	301·08		
590	310	316·45	311·45		
608	320	327·25	321·80		
626	330	338·22	332·40		
644	340	349·30	343·00		
662	350	360·50	354·00		

PART THIRD. *On the Measurement of Temperatures by Thermo-electric Currents.*

As the apparatus for developing a thermo-electric current may be made of very small bulk, and as we have the means of indicating currents of this kind of very small intensity, they have been used ever since their first discovery by Séebeck, for the purpose of measuring temperatures, especially within confined spaces. Pouillet has, moreover, utilized the same principle for the measurement of very high temperatures, and has compared his *magnetic pyrometer* with his air pyrometer, *(Elements de Physique, 4^me^ edition, tome II, p.* 684.—*Comptes Rendus de l'Academie des Sciences, tome III, p.* 786.*)*

The experiments related in this third part of the present memoir, were tried by M. Regnault, for the purpose of ascertaining how far instruments constructed upon this principle, could be relied upon as thermometers, and the conclusion to which he was led was, that no dependence, whatever, could be placed in the accuracy of their indications.

In order to avoid the difficulties arising from the use of the ordinary galvanometer, Pouillet's sine-needle, or the astatic needle, M. Regnault made use of a differential astatic needle, in which the system being first deflected by a current passing through one of its wires, from a couple iron-platina, was brought back by an inverse current from a pair of bismuth-antimony, passed through the other wire. Thus avoiding all errors or uncertainties arising from alteration of the magnetism of the needles, want of delicacy, or of true centering in the supports, or from too great or too small deflection of the needle from its normal position; while he found by experiment, that the electro-motive force of the bismuth-antimony was so much greater than that of the iron-platina, that a difference of temperature of 100° between the extremities of the latter, was compensated by one of 6°·5 in those of the former.

But when his results came to be projected graphically, the great irregularity and want of coincidence of the curves, shewed that no confidence could be placed in their indications. Sometimes these irregularities occurred suddenly in the midst of the experiments; at others, they took place more slowly. Moreover, when, after the experiments had been carried up to a high temperature, the apparatus was suffered to cool, and the observations recommenced without changing any part of the apparatus, the curve given by the second trial, was found to differ materially from that of the first. Many other combinations were tried, but the two above specified were found the best, and from these facts, M. Regnault concludes that, "if the numerous experiments which I have made upon thermo-electric currents, do not decide that these currents cannot hereafter be used for the measurement of temperatures, they shew, at least, that we are yet far from knowing all the circumstances which influence the phenomena, and from being able to fix the conditions under which thermo-electric elements must be established, so that the intensity of these currents may depend only upon the temperature."

M. Regnault attributes these irregularities principally to molecular changes in the metallic elements at the junctions heated.

Independent of their main purpose, these experiments appear to establish two interesting laws of the relation between the temperatures and the electric current established by them, viz:

First. That a difference of 1° between the two junctions of an element bismuth-antimony, produces sensibly the same deviation of the galvanometer, whatever may be the absolute temperatures, so long, at least, as these are comprised between 15° and 33°. (59° and 91°·4 F.)

Secondly. That an increase of 1° in the difference of the temperatures of the two junctions of an element bismuth-antimony, developes an electro-motive force which is less in proportion as the difference of the temperatures is greater.

General Conclusions.

"It results from the observations developed in this memoir, that the air thermometer is the only instrument of measurement which can, with confidence, be applied to the determination of high temperatures: it is the only one which we shall, in future, employ, when the temperatures exceed 100°."

"Our air thermometer will be founded upon the measurement of the changes in elastic force, experienced by the same volume of air when it is carried to different temperatures; the general disposition of the apparatus will be similar to that which we have already described."

"Ordinarily, air thermometers will be filled with dry air of atmospheric pressure, the reservoirs being in melted ice; sometimes, however, the included air will have the elastic force of the atmosphere only at 100°; and in some cases still more rare, this elastic force will differ from that of the atmosphere both at 0° and 100°. These differences, however, will not prevent the thermometers from being comparable, as we have already shown."

It is proper, whenever possible, so to dispose the air thermometer, that the elastic forces at 0° and 100° may be determined by direct experiment. But it will often happen that the direct determination of these two temperatures is impossible—and the starting points of temperature must then be taken by the mercurial thermometer, and the elements of the formulæ deduced by calculation. If the thermometer incloses air having an elastic force of 760 mm. at 0°, it will present at higher temperatures, the following elastic forces:

Table of the Elastic Force of Air at Different Temperatures.

Temperatures.		Elastic force.	Temperatures.		Elastic force.
Fah.	Cent.		Fah.	Cent.	
32°	0°	760 mm.	752°	400°	1856 mm.
212	100	1036	932	500	2126
392	200	1311	1112	600	2394
572	300	1584	1292	700	2661
662	350	1720	1472	800	2925

If the temperature is not raised above 350°, the outward elastic pressure will not be sufficient to produce any permanent alteration of

the form of the envelope. But at higher temperatures, this may be feared, as well on account of the great outward pressure as from the fact of the glass being sensibly softened by the heat. Therefore, to avoid the first difficulty, and partially the second, when the instrument is to be used for the measurement of high temperatures, the air should be introduced with a less elastic force.

When but a single temperature is to be determined, this may be done conveniently by the following arrangement of the apparatus. A globe of glass with a capillary stem, upon the extremity of which is cemented a steel tubulure provided with a stopcock, is arranged in the medium whose temperature is to be measured, so that the mouth of the tubulure just projects from its wall. The stopcock is left open, the apparatus being connected with a drying tube, until the moment when the temperature is to be measured; the stopcock is then closed, the height of the barometer noted, and the tubulure put into connexion with the manometer before described, the joint being made carefully air-tight. When the apparatus has returned to the surrounding temperature, the difference of height in the columns of mercury in the two manometer tubes, gives the means of calculating the temperature. The principal advantage of this method consists in the fact, that whilst the reservoir is hot, the inward and outward pressures upon it are equal, and there will be consequently no disposition towards a change of figure.

This arrangement is also very suitable for an air pyrometer, the glass globe and stem being replaced by similar vessels of platina. To obtain a capillary platina tube, M. Regnault proposes to take a cylinder of platina, to drill a hole of 2 or 3 mm. diameter along its axis, and fill it with lead, or tin, then draw down the cylinder in a wire-drawing machine, when the exterior diameter will decrease more rapidly than the interior. The tin, or lead, is then melted out, and the bore of the tube thoroughly cleansed by an acid. He states that he has, by this process, succeeded in obtaining capillary tubes of copper.

The sensitiveness of this apparatus will be less in proportion as the temperatures are higher, but it will always be sufficient, in consequence of the great precision with which we are able to measure the elastic forces of gas.

The greatest cause of uncertainty arises from the fact that we do not know the law of the dilatation of the envelope at these high temperatures; but the errors from this cause will not be very great. M. Regnault also suggests that when the experiments do not require a very great precision, a thermometer of the vapor of mercury may frequently be used to advantage for high temperatures. Take a vessel of porcelain, or sheet iron, having an opening in its tubulure, which opening may be closed by a sliding plate. Introduce into it some mercury, and over the mercury, a little naptha. Place the vessel in the medium whose temperature is to be measured, the tubulure being open. The vapor of the naptha will expel the air, and thus prevent the oxidation of mercury, which would otherwise take place at high temperatures. The mercury then boiling, its vapor will complete the expulsion of the air, and dilating like a permanent gas, will establish an equilibrium with the external pressure. When the temperature

is to be measured, close the tubulure by the sliding plate, and withdraw the apparatus; when it has cooled to the surrounding temperature, weigh the mercury which has condensed. The density of the vapor of mercury at 0°, and under a pressure of 760 mm., is 6,976, and consequently a litre weighs 9·020 grammes; then admitting for its dilatation the same coefficient as that for atmospheric air, we may determine the temperature of the medium to which it has been exposed.

(To be Continued.)

Experimental Researches on Figures of Equilibrium of a Liquid Mass withdrawn from the Action of Gravity: Second Series. By M. PLATEAU.*

The theory of capillary action, as established by the labors of Laplace, Poisson, &c., is not limited to the explanation of the cause of the ascension or the depression of liquids in narrow spaces, and the determination of the laws which regulate this phenomenon; it also permits, as is well known, of our arriving at the differential equation which represents the free surface of a liquid, in circumstances where the form of that surface is influenced by molecular attraction, as for example at the summit of the raised or depressed column in a capillary tube, along the sides of a solid body in part immersed, &c. But this equation cannot be integrated but by approximation, so that it is impossible to determine strictly the forms of the surface in question. On the other hand, on account of the preponderating action of gravity, the influence of molecular attraction can only become observable on surfaces, or portions of surfaces, which present but a small extent either in all directions or at least in one direction, such as the surface which terminates a capillary column, that of a liquid drop placed on a solid plane which it cannot moisten, the portion of the surface of a liquid raised along the sides of the vessel which contains it, &c. It would consequently be very difficult to verify by accurate admeasurements this important part of the theory; and it has hitherto remained almost without any other confirmation than that deduced from this simple aspect of the phenomena.

Now it will be remembered that in his preceding memoir (Taylor's Scientific Memoirs, part xiii. p. 16) M. Plateau described a simple process, by means of which he succeeded in completely neutralizing the action of gravity upon a liquid mass of considerable volume, at the same time leaving this mass perfectly free to obey the molecular forces. If, therefore, as in the case of ordinary capillary phenomena, the attraction of a solid system is interposed, the form which the free surface of the mass will assume will be identically the same as if the liquid had been in reality deprived of all gravity. But then the equation relative to the surfaces of equilibrium is reduced to a very simple form, which allows, in several cases, of omitting the integration; and,

* From an abstract by M. Quetelet, published in the *Bulletin de l'Académie Royale de Belgique.* The First Series of these interesting investigations appeared in the 13th part of the Scientific Memoirs.

on the other hand, nothing any longer limits the extent which may be given to surfaces, so that the results of experiment are susceptible of exact admeasurements. We are thus able to submit the theory to numerous and perfect verifications. This is one of the objects which M. Plateau proposed to himself in his researches, starting from the second series now laid before the Academy.

But his ingenious experiments, besides the support they give to the theory of capillary action, have another kind of interest, in so far as they exhibit the curious spectacle of figures of equilibrium suitable to a liquid deprived of gravity; the theoretical and experimental study of these figures forms a second object of research. The equation representing these figures shows at once that the sphere, the plane, and the cylinder, must be found among them; now, the author has shown, in his preceding memoir, that when the liquid mass of his experiments is not adherent to any solid system, it always assumes precisely the spherical form. With respect to plane and cylindrical surfaces, as they are from their nature indefinitely extended, the first in all directions, and the second in the direction of its axis, it is evident that they cannot be assumed by a finite and entirely free mass; but the author obtains portions of them by causing the liquid mass to adhere to suitable solid systems.

The results at which he arrives on this subject lead him to realize polyhedrons entirely liquid, with the exception of their angles, which are formed of thin iron wires. He produces the cylinder by attaching the liquid mass to two rings of iron wire placed parallel one to the other.

The observation of certain peculiar facts relative to these liquid figures leads the author to several important consequences, among which we may mention the indication of a mode of experiment which would perhaps allow of arriving at the determination of a limit above which must be found the length of the radius of sensible activity of molecular attraction.

Lastly, the author deduces from a property of the liquid cylinder the complete theory of the constitution of liquid veins discharged through circular orifices,—a constitution so completely investigated experimentally by Savart, the cause of which, however, has remained without any satisfactory explanation. Although such a vein be formed of a liquid freely submitted to the action of gravity, M. Plateau shows that we may apply to it, somewhat modified, the considerations relative to a liquid upon which this force does not act.

The author announces, in conclusion, that in the following series he shall direct his attention to other figures of equilibrium of revolution than the sphere and the cylinder, and to figures not included in that class for which the equation may be interpreted in a strict manner.

Lond. Phil. Mag.

Description of Mr. Frederick Ransome's *Process for Making Artificial Stone.*

The first meeting of the Session of the Institution of Civil Engineers,

was held on Tuesday evening, January 11th, 1848, when a paper was read, descriptive of Mr. Frederick Ransomé's progress for making Artificial Stone. The *modus operandi* appeared to be very simple. Broken pieces of silica (common flint) being subjected for a time to the action of caustic alkali, boiling under pressure in a close vessel, formed a transparent silicated solution, which was evaporated to a specific gravity of 1600, (distilled water being 1000), and was then intimately mixed with given proportions of well-washed sand, broken granite, or other materials of different degrees of hardness. The paste thus constituted, after being pressed into moulds, from which the most delicate impressions were readily received, was subjected to a red heat, in a stove, or kiln, by which operation the free, or uncombined silica of the raw materials united with the excess of alkali existing in the solution, thus forming a semi-vitreous compound, and rendering the artificial stone perfectly insoluble. This production must evidently be adaptable to a comprehensive range of objects, for decorative art and architectural purposes; busts, vases, flooring tiles, steps, balustrades, mouldings, capitals, shafts, and bases of columns, &c., &c. Even grinding stones and whetstones for scythes have been made; and in fact, from the beauty and variety of the specimens exhibited, there would appear to be a vast field opening for such a production. It was stated to be extensively manufactured at Ipswich, and it was allowed to admit of extensive application, where elaborately carved stone would be too expensive. Lond. Artizan.

Experimental Test of the Value of Marine Glue for Ship Building purposes.

The Lords Commissioners of the Admiralty issued instructions in January, 1843, to the master shipwright of Chatham Dockyard, to have the mainmast of the *Curaçoa*, 24, then fitting at that port, joined with marine glue, to test its capabilities for that purpose. The mast was accordingly made of several pieces of timber joined together, under the immediate superintendence of Mr. Jeffrey, and when completed, measured 28 inches in diameter, and 66 feet in length, and, when put up with the topmast, 90 feet 10 inches. The *Curaçoa* was soon after commissioned by Captain Sir Thomas Pasley, Bart., and proceeded to the South American station, and after serving the usual period was ordered home, and recently paid off at Sheerness. The vessel having been dismasted, their Lordships ordered that the mast should be opened, as is usual after four years' service, to ascertain its present condition. The master-shipwright, Mr. Watts, at Sheerness Dockyard, in compliance with their Lordship's order, set eight men to work with sledge hammers and wedges to separate the timbers, but their whole united efforts at one time, failed in separating the joints, and only split the solid timber into large pieces. Mr. Watts then considered it best to have the mast cut into sections about eight feet long, for one piece to be transmitted to each dockyard, to satisfy the master-shipwrights that they were correct in their judgment when they assembled in committee and reported to the Government, that this in-

vention was "one of the most valuable discoveries of modern days for ship-building purposes." On the mast being cut into pieces, it presented a most perfect and sound interior throughout, and the marine glue was as perfectly adhesive as a fortnight after its application. The foremast which was joined in the upper part in the usual manner adopted at the dockyards, was found to be very rotten, the parts where the wet had entered and been retained, yielding to the pressure of the hand like a piece of sponge, and in other places, where dry, crumbled into powder on being pressed. The original cost of a mast of the same dimensions as the mainmast of the *Curaçoa* is upwards of £250; and now that it has been proved by upwards of four years' trial, that "made" masts joined with marine glue are equally serviceable after that period as when first made, the saving to the country would be very great were all the future made mainmasts for vessels and ships in the Royal Navy to be joined with that substance. **Lond. Mech. Mag.**

Description of Jones's Gas Exhauster, and its Application, as a Substitute for the Fan, for blowing Cupolas, or Smithies.

Jones's Gas exhauster is a machine invented for the purpose of taking the gas from the retorts as fast as it is generated, and forcing it into the gas holders, in order to relieve them of the backward pressure. It has been at work for the last four years in many large manufactories with great success, and it has occurred to me that it might be used with equal advantage as a substitute for the fan in blowing cupolas or smithies.

The machine consists of a spheroidal case flat-sided, into which are fitted two revolvers of a peculiar shape, which turn on separate axes, and are so fixed in relation to each other, that in every part of their revolution there must be a complete separation between the air on one side of them and that on the other. Motion is given to these revolvers by means of a pulley upon the axis of the lower one; on the other end of which axis is a toothed wheel, working in another toothed wheel of equal number on the end of the axis of the revolver, thus causing them to work in perfect uniformity. The action of the apparatus is precisely that of two pistons working within two chambers alternately opening and closing, and delivering at each revolution a quantity of air equal to the contents of each chamber. As there are no data of the quantity of air a fan of a given size will discharge, I cannot compare the efficacy of the exhauster with it; but when I see the best constructed fan, at its greatest velocity, will only contain a density of air equal to a column of water of 10 in., or a pressure of about 15 oz. on the square inch, and that the exhauster will maintain a density of 50 in., or about 75 oz., on the square inch, and that with a comparative small amount of power, I am led to believe that some advantage exists in the exhauster over the fan.

In an experiment I recently made with an exhauster, 2 ft. by 1 ft. 6 in., and 1 ft thick, I found I could discharge 30,000 cubic feet of air per hour, with a constant resistance of 15 oz. on the square inch. This

(according to the theory of re-smelting iron in a cupola which allows 36,000 cubic feet, or, 2700 lbs. of air to one ton) would be nearly equal to 1 ton of iron per hour, and with an expenditure of not more than 2 horse power. This quantity, of course, could be considerably increased by using a larger sized exhauster.

Mr. Clift observed that it was a spheroidal figure, in which curved figures were revolving in different directions, and the air being admitted, was thrown into the receiving chamber at every revolution. Each revolution throws out a portion of air equal to the chamber.

Mr. Buckle affirmed that the revolver would not answer if driven with spur wheels, as the rate of velocity required to produce any great amount of pressure and quantity for cupolas or smelting purposes, would endanger the safety of the wheels.

Mr. Clift replied, that Messrs. Elkington, Mason, & Co., of Birmingham, had been in the habit of using a fan for the blowing purposes in their manufactory, but had lately removed it, and substituted Jones's exhauster in its place; and they had found it to answer their purpose much better, as they had a greater density than formerly. He also stated that a larger one was in course of erection, and after it had been tried he would report to the Institution the result.—*Proc. Insti. Mech. Engineers.* Artizan, Jan., 1848.

Lecture on the Electricity of Mineral Veins. By Mr. Robert Hunt, *at the Royal Institute.*

Mr. Hunt commenced his lecture by remarking, that the class of phenomena which would form the subject of consideration that evening, although of the highest interest, had not yet received so great an amount of experimental examination as their importance required; and, as their curious nature was, consequently, not generally known, he trusted that, having spent many days and nights in the mines of Cornwall, in this investigation, he should be able to interest his audience by a narrative of the facts now known, as well as some of a novel character.

As a preliminary of absolute necessity, the lecturer explained the nature of a mineral lode by the aid of a beautiful isometrical drawing of the lead district of Nentsford. A lode was, in fact, a fissure, formed by some disturbance of the earth, and filled with mineral deposits. Three theories prevailed as to the origin of mineral lodes; in the first place, they were supposed to be contemporaneous with the rocks themselves; secondly, it was conceived, that fissures were filled by the sublimation of matter from great depths in the earth; and, lastly, that substances were precipitated from solution in water, which flowed through those great rents in the earth. A mineral lode was not to be regarded as being entirely composed of metallic substances; on the contrary, they were most frequently found containing a large portion of earthy matter, amongst which the metallic ore was disseminated. Among the indications which appeared to support the theory of electrical action in these formations, was to be regarded the regular disposition of these substances on either side of the lode. The electrical theory might

be explained in a few words. Ampere supposed that currents of electricity traversed the earth from east to west, and these currents were thought to influence the chemical changes which had gone on within the fissure during the formation of the lode, and determine the order of arrangement. The most striking conditions which appeared favorble to such a view were, that metals of various kinds were found associated with peculiar classes of rocks—tin and copper being associated, in a remarkable manner, with the primary rocks; whilst lead was found more abundantly in the limestone formations. These rules, although general, were not constant—many striking exceptions might be named. In the remarkable mining county of Cornwall the rocks were granite, killas, or clay-slate, greenstone, and elvan. The mineral lodes were always most abundant near the junction of the slate and granite rocks; they were generally found in a direction nearly from north-east to south-west; and where they were contrary to this, or nearly in the line of the magnetic meridian, there was almost invariably a great difference in the character of the mineral substances contained in the lode. This was shown by reference to a very large map of Cornwall, upon which the lodes of lead and copper were accurately marked. Again, a very remarkable parallelism was observed in most districts between the directions of the lodes, and the veins of granitic porphyry (elvan) which occurred in the vincinity; and this fact had been brought in support of the theory, which refers mineral formations to the action of subterranean heat.

The various questions which arose out of the phenomena of mineral veins, and their including rocks, had been most ably treated of by Sir Henry De la Beche, Mr. Joseph Carne, Mr. R. W. Fox, Mr. John Taylor, Mr. Hopkins, and others; he would not, therefore, dwell on that part of the subject.

The lecturer then proceeded to examine, whether any of the conditions known to belong to the rock formations of a mining district were sufficient to produce electrical phenomena. It had been ascertained that granite was always colder than slate—a difference of 2° or 3° was always detected at all depths. This difference might possibly give rise to weak thermo-electric currents; but in the experiments he (the lecturer) had made, to ascertain this point, no such currents had been detected. It was also well known that a constantly increasing temperature was discovered as we descended into the earth. By this means, it was evident that any given portion would represent a bar unequally heated. The following table of temperatures, obtained in the rock and lode, exhibited the variations of temperature in the deep mine of Tresavean:—

At sea level,	In granite,	57° F.
At 170 fms.,	Lode in slate,	77° F.
At 196 fms.,	Do. in granite,	83° F.
At 208 fms.,	Do. in granite,	85° F.
At 310 fms.,	In granite,	94° F.

According to the generally received views of thermo-electric action, such differences would be sufficient to produce currents. That was

undoubtedly the case in metallic and good conducting bodies, but no such result had been obtained from experiments on granite, slate, or greenstone.

[A series of experiments were here introduced—and, notwithstanding the use of an active galvanic series, it was shown that the voltaic current would not traverse either granite, slate, elvan, or greenstone—connexion being made with them and a very delicate galvanometer, upon which, not the slightest indication of any action on the needles could be observed.]

When moist, these rocks became over their surfaces conductors; and, by this means, the action on a single pair of zinc and copper plates, not more than an inch square, was detected through a considerable extent of country. Mr. W. J. Henwood had supposed that he had detected currents of voltaic electricity through the granite and slate rocks of Cornwall; but the lecturer, who had repeated those experiments with great care, was led to believe that the slight deflection of the needle obtained, was due entirely to some chemical action in the wires employed at the point of contact with the rock, or within its length—such slight disturbances being of constant occurrence in all experiments of this class. Although there was not, therefore, any experimental evidence in proof of the voltaic condition of the rocks, yet the regularity of arrangement observed in the lodes themselves—in which zinc, copper, and quartz, lime, pyrites, barytes, fluor-spar, argentiferous lead, and quartz, alternated in the most regular order, as was shown by specimens from the mines of Cornwall, Derbyshire, Saxony, and Mexico—present features so analogous to those which often appear in galvanic experiments, that we are compelled certainly to infer that some modification of the electric force was concerned in the phenomena. Specimens of pseudomorphous bodies from the Cornish mines, and arrangements of brown spar upon quartz, from Schemnitz, quartz upon fluor spar, and iron pyrites, and the double sulphuret of copper upon large quartz crystals, in all of which a uniform system of arrangement, perfectly independent of each other, was shown—and these were to be referred, in all probability, to the disposing power of electrical currents.

Such were the principal evidences to be adduced in support of the electrical theory. Mr. R. W. Fox was the first to discover any indications of electricity in mineral lodes. By placing copper wires against two portions of a lode, or of two lodes divided by a cross-course, and connecting those wires with a galvanometer, a considerable deflection of the needle was obtained—often to such an extent, that, from the violence of the action, it was impossible to note the deflection. In nearly all the mineral lodes of Cornwall, upon which experiments were made, these currents had been detected. Experiments made by Mr. Fox, in Coldberry and Skeers, in Teesdale, gave, however, negative results; and the results on the lead lodes at the Mold Mines were not very decided. Prof. Reich, of Freyburg, obtained very decided results upon the lead and silver lodes of that district; and, in one case, succeeded in detecting a mass of silver ore at some distance behind the rock. Von Strombeck, on the contrary, could obtain no results from

the lead and copper lodes on the right bank of the Rhine. In addition to these results, others of a most satisfactory kind had been obtained by Mr. Henwood and Mr. John Arthur Phillips. The lecturer had, himself, almost invariably obtained very decided galvanometric indications from the copper lodes of Dolcoath, East Wheal Crofty, East Pool, and other Cornish mines—in one instance so powerfully, that electro-chemical decomposition was produced. Mr. Fox has been successful in procuring an electrotype copy of an engraved plate by the current collected from two lodes of iron and of copper pyrites, and also in inducing magnetism in a bar of soft iron. Mr. Pattinson, at the wish of the British Association, made a series of experiments on the rocks of the limestone formation in the lead districts of the north; but he could not detect any evidence of electrical currents.

It now became a question, to ascertain if these currents of electricity, detected in mineral lodes, were in any way connected with the general currents traversing the earth, according to the theory of Ampere; or, were they of a more local character? The lecturer was induced to conclude, from all his experiments and observations, that these currents were entirely local, and due to the chemical action going on within the lode itself. In all cases where chemical action could be detected, it was certain the current acting on the galvanometer, was more energetic than where no chemical change was apparent. In this way might be accounted for the failure of Von Strombeck on the lead and copper lodes of the Rhine, and of Mr. R. W. Fox himself on the lodes of Teesdale—in all probability, those lodes being in a very permanent condition. It was thought by the lecturer that the fact, that these currents often being found to traverse the lodes in a direction contrary to the currents of Ampere, and frequently at right angles to them, militated against that view which referred the one to the influence of the other. The lecturer had also detected currents from piles of ore on the surface, which had been exposed to the influences of the atmosphere; and these currents were certainly only measurers of the amount of chemical action going on in the pile.

That these local lode currents might have a powerful effect upon masses of matter exposed to their influence, was highly probable; and he was disposed to refer the conditions in which cobalt and nickel were often found in the cross-courses, between the ends of dislocated lodes, as due to this local chemical electricity. The character of many of the decomposing lodes was next described; and it was shown that, under the influence of the percolation of rain-water from the surface, charged with oxygen, and the action of the saline water rising from below, few lodes admitting water to flow through them, could be free from chemical action. He had analysed the waters of many of the deep mines, and the following were the results of a few of these analyses:—

The water from Great St. George contained, in a cubic foot, 590 grains of common salt; that of the United Mines, rising hot, 481 grs.; of Dolcoath, 218 grs.; of Great Wheal Charles, 612 grs.; Consolidated Mines, at 80 fathoms, 656 grs., and at the 250 fathom level, 918 grs. This muriate of soda was estimated quite independently of the earthy and mineral salts. It was, doubtless, derived by infiltration from the

ocean; and, from its quantity, acted, no doubt, powerfully upon the lodes it traversed.

Although these currents, detected by the galvanometer, were not re garded by the lecturer as in any way proving electrical agency in the formation of mineral veins, yet the evidence obtained by Mr. Fox, by Mr. Jordan, and more recently by himself, that electricity would give to clay a schistose structure and form along a curved line, no doubt related to some line of electrical action—a miniature lode of copper (of which illustrations were exhibited) supported the general view of electrical action. Incidentally, the conducting powers of iron and copper pyrites, galena, and some other minerals, were experimentally shown; and also the decomposition of yellow ore by electrical action.

In conclusion, the lecturer carefully recapitulated all the main points of evidence, for and against the electrical views, and pointed out many very curious circumstances, evidently dependent upon some peculiar conditions of the adjacent rocks, but which could not be referred, with any certainty, to electrical action. Probably, those currents, which now nearly determined, as in constant flow around the earth, might produce the curious results observed; but a far larger amount of experimental evidence than that yet obtained was required, before this view could be admitted as one of the received facts of inductive science

Lond. Min. Jour.

Description of a New Lever Vise, patented in December, 1843. *By* Mr. J. Peck, *and* Mr. L. Pardee, *of New Haven.*

The accompanying cut and description will explain the principle; it is made entirely of wrought iron, and possesses all the necessary qualities wanted by machinists, cutlers, smiths, and all others who use vises of any kind.

The following qualities, it is claimed, give it a decided superiority to all other vises:—

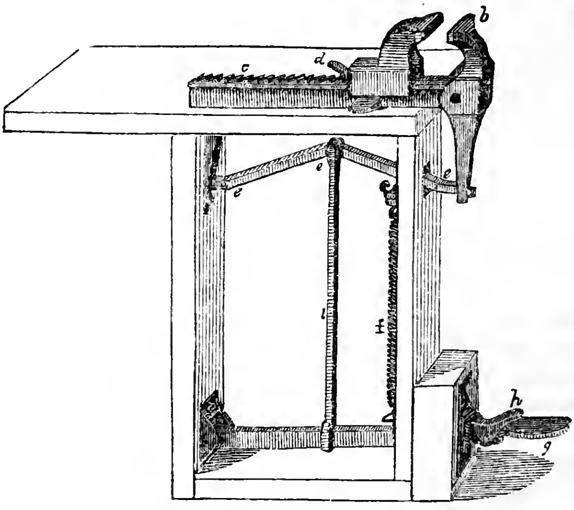
Greater strength than any other vise of equal weight possesses. Greater power, and so applied as to save, in work requiring frequent changes, at least one hour in ten, as it is worked entirely by the foot, without the necessity of laying down a file, or other tool, or without any use of the hand, whatever. It can be changed to receive work from one-sixteenth of an inch, to eight or ten inches in width, as easily and as quickly as any other vise can be moved one-fourth of an inch. And heavy work, requiring both hands to lift, can be easily placed in the vise, without calling the assistance of a second man; it will soon pay for itself in saving of time. It is much easier for the laborer, the strain upon the breast in turning up a screw is entirely avoided, and the vise can be closely approached without being obliged to bend the body over the end of the screw, as in other vises.

When the vise is forced up, it becomes more firmly attached to the bench than any other vise can be, rendering the whole much more solid, which in chipping, and other heavy work, is very desirable.

These vises have been used nearly a year in some of the principal machine shops in the country, and prove all that is claimed for them.

The subscriber has made arrangements for manufacturing these vises, and from the encouragement already received, is induced to believe that the demand for them will be very large, he intends to be supplied with them of all sizes, and will endeavor to be able to fill all orders at short notice. As they are made wholly of wrought iron, the cost will exceed that of cast vises; they may also cost something more than the wrought English vise, but I am assured by an extensive machinist, who has put them to a very severe test, that he finds one of these vises of fifty pounds weight possesses as much strength as the best English vise of seventy pounds. They are offered to the public with a conviction, strengthened by the experience of some of the best mechanics in the country, that they will prove, strength and durability considered, the cheapest, as they are by far the best vise in use.

J. S. Griffing.



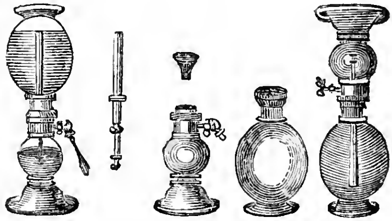
a, sliding jaw. *b*, jointed, or swinging jaw. *c*, rail on which the sliding jaw moves. *d*, click which catches in rachet on rail *c*, and holds the sliding jaw firmly where placed. *e*, jointed lever, (elbow joint,) which turns on pins *e e*, and is attached to prong of rail *c*, and the lower end of the swinging jaw. *g*, foot lever with joint attached to leg of bench, and connected by rod *i* with jointed lever. *h*, click which catches in rachet at the foot of the forward bench leg, and holds the jaws firmly as forced up by the combined levers; it is easily tripped with the foot. *f* is a spiral spring which lifts the foot lever, and throws open the jaw.

Briet's Apparatus for Making Mineral Waters.

Translated for the Journal of the Franklin Institute.

This apparatus has already been favorably reported on by the Society for the encouragement of National Industry, and by the Royal

Academy of Medicine. And as it presents a simple and easily manageable form of apparatus, which may be useful or convenient to our readers under certain circumstances, we take the description of the most recently improved form from the Journal de Pharmacie et de Chimie, for January, 1848.



1 2 3 4 5

Two vessels of different capacity, represented by figs. 3, and 4, capable of being screwed together, with a metallic tube represented in fig. 2, compose the apparatus. The vessel 3 is intended to receive the mixture which produces the gas; the vessel 4 is the reservoir in which the liquid is impregnated with it. The apparatus is unscrewed and the vessel 3 placed in the position of the figure; then, by means of a small metal funnel shown above it, 18 grammes (278 grains) of tartaric acid, and 21 grms. (324 grains) of bicarbonate of soda, both reduced to powder, are successively introduced. The metallic stem, fig. 2, is then put in. It consists of a hollow metallic stopper, fitting the mouth of No. 3, and surmounted by a hollow tube, divided throughout its whole length into two compartments, by a longitudinal metallic partition. In the lower part of the stopper is a hollow space, widely open upon the sides, and containing a small ball of glass. In the position in which the tube is placed upon the vessel 3, the ball leaves the opening of the stopper free; but when the apparatus is reversed, the ball closes this opening.

The vessel 4 is then filled with cool water up to the neck. Then the vessel 3 with its metal tube, is turned upside down, and screwed upon No. 4, as is shown, fig. 5. The glass ball then closes the opening of the tube, so that the acid and salt cannot enter the lower vessel. The whole apparatus is then inverted so as to take the position fig. 1. Then by one of the compartments of the tube, the water of the carafe descends into the lower vessel, and continues to descend until it reaches the level of the upper edge of the tube, while the air in the lower vessel ascends by the other compartment to take its place. The descending water dissolves gradually the tartaric acid and carbonate of soda, and carbonic acid is disengaged, which rises into the upper vessel, and under the pressure which it exerts, is dissolved in the water therein contained. The apparatus is shaken from time to time, to facilitate the solution of the gas.

When cool water is used, the operation is finished in less than ten minutes, and the water may be withdrawn as it is wanted, by a screw stopcock. The water which remains, keeps perfectly well.

M. Bussy, who has examined and reported upon this apparatus, and

M. E. Soubeiran, from whom we take the above description, say that the water made in this way is of excellent quality. The apparatus will serve equally well for the preparation of effervescing lemonades, or wines, or mineral waters charged with different salts, by replacing the water of the carafe by the appropriate liquid. The apparatus is made of very thick glass, and each piece is submitted, before sale, to the test of a very strong pressure; for greater security, the two vessels are covered with plaited reeds, which, in case of fracture, prevent the glass from flying. This effect has been proved by actual experiment.

Soubeiran's Recipe for Indelible Ink.

Translated for the Journal of the Franklin Institute.

Crystallized nitrate of silver,	8	parts by weight.
" " of copper,	3	"
" carbonate of soda,	4	"
" aqua ammoniæ,	100	"

Dissolve and keep in a well-corked bottle.

This ink is, of course, to be used without any preparatory liquid. But as the editor of the Journal de Pharmacie justly remarks, requires a certain quantity of gum (say—gum-Arabic pulverized, 50 parts,) to allow it to be used as an ink.—*Journal de Pharmacie et de Chimie, February,* 1848.

Test for Organic Matter in Solution in Abnormal Quantities in Water.

Translated for the Journal of the Franklin Institute.

M. Alph. Dupasquier proposes the chloride of gold for the purpose of detecting organic matter when present in water in such large proportions as to make it unhealthy to drink, or improper for use in the arts.

Into a small glass vessel he introduces from 20 to 25 grammes, (300 or 400 grains,) of the water to be tested, and adds a few drops of a solution of chloride of gold, (carefully freed from excess of acid,) so as to give it a slight yellowish tint: the liquid is then boiled. If the water contains only the quantity of organic matters common to drinkable waters, it retains its color, even after long boiling. But if, on the contrary, it contains an abnormal quantity, it first turns brown, then takes a violet, or blush tint, which indicates the decomposition of the gold salt by the organic matter. By prolonging the ebullition, the violet, or bluish tint becomes deeper and deeper, if the proportion of organic matter is considerable. But a slight brownish, or greenish tint, is sufficient to indicate certainly, that the quantity of organic matter is greater than usual.

The salt must be used without excess of hydrochloric acid which interferes with the reaction.

Very often, during a somewhat prolonged ebullition of the liquid, the

oxide of gold precipitates, owing to the reaction of the carbonate of lime upon this salt; then if the chloride of gold is not in excess, the liquid is decolorised; or if in excess, the shade of color may be changed by a slight cloud which appears. To distinguish this reaction from the former, it is only necessary to add one or two drops of pure hydrochloric acid, which will immediately dissolve oxide of gold, and the color is restored. But when the gold has once been brought to the metallic state by the organic matter, it is not re-dissolved by the hydrochloric acid, and the liquid remains violet, bluish, brownish, or greenish violet, when there has been a tolerably great excess of chloride of gold. If, however, the liquid contains a trace of a nitrate, if it be re-boiled, the gold may re-dissolve.—*Journal de Pharmacie et de Chimie, March,* 1848.

A Liquid for Cleaning Metals.

Translated for the Journal of the Franklin Institute.

"One of the first operations in finishing metallic work after it comes from the casting, or from the hammer, is to free it from the coat of oxide which adheres to it: this is done, generally, by keeping it for some time in water, strongly acidulated with sulphuric, or muriatic acid. But an inconvenience in this process arises from the fact, that the metal is liable to be attacked on its lines and angles, and wherever it presents a point or edge. Hence arises a double loss, both of the acid employed and of the metal.

MM. Thomas, and Dellisse, state that they have succeeded in avoiding these inconveniences, by combining with the acid of the bath, certain organic matters which have the property of preventing, or at least of considerably diminishing, the attacking of the metal by the acids. According to them, glycerine, artificial tannin, napthaline, and kreosote, attain this end. In the baths thus composed, the scale of oxide detaches itself without dissolving, and without the metal being attacked, so that the pieces may remain in the bath as long as may be desired, without alteration.

These facts announced by MM. Thomas, and Dellisse, are corroborated by the experiments of M. Flachat, chief engineer of the Versailles and Saint Germain railroad. M. Mertian, proprietor and director of the forges of Montataire, and M. S. Falatieu, forge master at Bains, testify that they have tried this process upon sheet-iron, and have adopted it to the exclusion of all others. The economy of this process, compared with the former ones, is about two-thirds of the acid employed, and 50 pr. ct. of the loss of metal in cleaning."—*Bull. Soc. Enc. Indus. Nat., January,* 1848, *p.* 51.

Process for Gilding the Wheels of Watches and Chronometers. Submitted by M. Plantamour, *to the Academy of Sciences, Paris, at a late Sitting.*

The desire for improvements in the construction of time-keepers,

with the view of obtaining the greatest correctness, combined with elegance, has led to the practice of gilding the wheels. Gilding by mercury is impracticable, as it requires an amalgam surface, produced by an acid solution of mercury in aquafortis; the application of which would completely destroy the steel pinions.

The present process obviates this: it consists in using for the amalgamation, a solution of mercury, which will not effect the steel, either in a cold or warm state. To prepare this liquor, a small quantity of mercury is dissolved in a quantity of nitric acid, sufficient for this latter to be in excess; the solution is afterwards saturated by ammonia, and the precipitate is then re-dissolved in an excess of the alkali.

To operate upon the wheels with this solution, no great precaution is necessary; they may be immersed entirely in it, and left there for several minutes, without the pinions being in the slightest degree injured. The ammonia in excess rapidly cleanses that part of the wheel which is to be gilt, and the surface becomes very speedily amalgamed.

In order to apply the gold, the wheels must be withdrawn from the mercurial solution, and the amalgam of gold is laid on without the necessity of wiping them. This being done, they are heated upon a small cylinder, or drum, made of sheet-iron, a spirit lamp being applied underneath. The upper surface of the cylinder has a hole made through it, to admit the pinion, and allow the gilt part of the wheel to be heated, without heating the pinion to an extent which would affect its temper. By means of a coarse brush, the grained, or deadened appearance, usual in the works of watches, is produced; and after cleansing with a scratching brush, and soap and water, the wheel will be gilt and finished; the pinion remaining as bright as it was before the operation.

By means of this process, chronometers, intended for long voyages, may be protected from the influence of the sea air, which often deposits saline particles.—*Bulletin de la Société d'Encouragement.*

Lond. Journ. Arts, & Sci.

On the Advantage of Electrotyping Daguerreotype Plates. By WILLIAM E. KILBURN.

The following simple experiment, demonstrating the advantages of electrotyping Daguerreotype plates, may be interesting to many of our readers, but more especially to amateurs in that beautiful art.

Purity of silver for the plates has always been much insisted on; and of the various means that have been resorted to to obtain this, the battery process offers the most simple as well as the most satisfactory means of accomplishing it.

Prepare a plate for silvering; but in the place of depositing electrotype silver over the whole face of the plate, only permit the deposit to take place over one-half, by immersing the plate only half way in the decomposition trough. [With a one quart Smee's battery, one minute will be sufficient.] Finish the plate afterwards on removing it from the battery in the usual way, as when preparing it to receive the sen

sitive coating; and when "cross buffed," it will be perceived, on examing the surface, how much *blacker* and more brilliant is the polish on the electrotyped silver half, the remaining half appearing by contrast, quite greasy. The importance of this depth of black will at once be appreciated, when it is remembered that it is the black burnish of the silver which forms the dark portions or blacks of the Daguerreotype picture. If the plate thus prepared, be now made sensitive and placed in the camera, it will be found that the electrotype half has also an advantage in sensitiveness, the "halved image" being about four seconds, or about one-third of the exposure in advance of the other side not coated in the battery. I have tried this with a great variety of solutions, and always with the same result.

Lond. Edin. & Dub. Phil. Mag.

On the Separation of Sulphur from Ores. *By* MR. JOHN HOWSON.

SIR,—In the paper of M. Sinding's, on mundic and its uses, which appeared in the last number of the *Mining Journal*, is a powerful confirmation of the ease with which steam effects the separation of sulphur from minerals. The frequent recourse which has been had to sublimation, the varied success that has attended its application, and the low produce thereby obtainable, prove, incontestibly, that it is not adapted for the production of large quantities of sulphur at a cheap rate; while the trials of M. Sinding, though undertaken with the view of improving the sublimatory process, point to steam as the only agent by which it can be permanently established. Throughout his experiments, the moisture frrom the fuel and the furnace, being converted into steam, and carried, with the vapors of combustion, over the heated ore, decomposed it, with the production of oxide of iron and sulphuretted hydrogen gas, in such abundance as to render the presence of the latter very objectionable. This gas exhibited itself contemporaneously with the sublimation of the sulphur—clearly evidencing, that the heat necessary to its production, is not greater than that required to drive the sulphur from the ore; and, while the greatest amount, capable of being obtained by this process, is not more than 16 or 17 per cent., decomposition by steam would give the whole, or 53 per cent., leaving the ore in a better condition, and free the sub-sulphate, which usually attends the common calcining methods. The plan employed to bring the sulphur, in the sulphuretted hydrogen, again into the solid form, is a simple and natural operation; merely requiring, that the admission of air to the furnace should be so regulated, as to convert one-third of it into sulphurous acid gas; which, by combining with the remainder, would cause mutual decomposition to take place, and the sulphur from both gases to be deposited. Had advantage been taken, by M. Sinding, of this plan, and a due supply of air admitted to the sulphuretted hydrogen formed, the inconvenience arising from this gas, would have been overcome, and the per centage of sulphur necessarily augmented.

The immense quantities of sulphur which are annually wasted at the various metallurgic establishments of this country, and the exten-

sive deterioration of atmosphere consequent thereon, and the practice of resorting to foreign countries for our supply, when such vast beds of ore, capable of yielding it at a cheaper rate, remain untouched, is a disgrace to a commercial community. **Lond. Min. Journ.**

Linen Fired by Solar Heat.

In the case of a fire which occured on Monday week, in a warehouse at St. Paul's Churchyard, Mr. Braidwood reports to the insurance offices that the cause of it was the firing of a linen curtain first at the open part of a window. It seems doubtful, however, whether by "the open part" of the window he means that the sash was open, or merely that the fire originated by the solar action through the glass where exposed openly to the solar ray. The heat was lately, it is said, 21 degrees above the average of the same time of the year for twenty-five years past; but the firing of linen by the unconcentrated rays of an English sun in May, would be a phenomenon likely to startle the linen-clad denizens of the tropical south. **Lond. Builder.**

FRANKLIN INSTITUTE.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on the Explosion of a Stationary Engine.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, by whom was appointed a sub-committee to examine into the cause of the explosion of a stationary engine in Maiden Street, Philadelphia, on the 2nd day of May, 1848,

Report, That the boiler consisted of two concentric cylinders, placed with their axis vertical. The outer one was 10 feet long, and 4 feet in diameter; the inner one was 8 feet long, and 3 feet 7½ inches in diameter. They were made of ¼ inch boiler iron, and were connected together at their lower edges. About 2 feet below the top of the outer cylinder, the inner one was closed by a stout circular head of boiler iron, ½ inch in thickness, which was connected with the head of the outer cylinder by four double wrought-iron stay-bolts. Through this lower head passed 78 wrought-iron tubes about 6½ feet long, of which 48 had an internal diameter of 2 inches each, and 30, of 1¼ inches, arranged in concentric circles, around a large central tube of the same length, 7½ inches in internal diameter. They were all closed at their lower ends. These tubes were firmly secured into the head of the inner cylinder at their upper ends, and were suspended from it in the furnace. The furnace consisted of the space inside of the inner cylinder, the lower edge of the fire-door being on the level of the junction of the two cylinders, and the flue or smoke pipe entering just below the lower head or tube-sheet. It will be seen that the water or steam space consisted of the upper part, about two feet in length of the outer cylinder, the space between the two cylinders,

and the inside of the tubes. There were no stays connecting the two cylinders, except those which have been already mentioned as passing between the two heads. The furnace was interior, and the whole of the surface exposed to the action of heat, with the exception of the areas of the bottoms of the tubes, and the tube sheet which was far removed from the fire, was arranged vertically. The feed water was introduced into the space between the two cylinders about 3 inches above their lower junction, and upon the right side of the fire door. There were three gauge cocks in the upper part of the boiler, the lower one of which was disused, having become obstructed; the second was 8 inches above the tube sheet, and the third 7 inches above that. This boiler was usually connected with another horizontal boiler, 13 feet by 3½, consisting of two concentric cylinders, with 10 crossing water tubes, 7 inches in internal diameter. The water spaces of the two boilers were connected below, and a pipe passed from the upper part of the horizontal, into the steam space of the vertical boiler. This boiler was however not in use at the time of the accident.

The boiler was thrown nearly vertically upwards, passing through the upper stories of the building, upon the ground floor of which it was placed, and after having risen, according to the evidence of eye-witnesses, to a very great height in the air, fell in the street at a distance of about 70 feet from its point of departure.

Upon examining the boiler, the committee found that the inner cylinder had given way near the bottom. The rivets between the lowest and second sheets had been shorn off, and the line of separation was continued on one side by the tearing of the iron, so as to pass about half way around the boiler, and at each end of the fracture there was a short tear in a vertical direction. The inner cylinder had been forced in upon the tubes, which were displaced and crowded together, and was folded as shown in the accompanying diagram which represents the appearance of a cross section made just above the top of the fire door. The centre of this line of fracture was diametrically opposite to the feed pipe. This yielding of the inner cylinder was less towards the tube sheet, above which the boiler was apparently totally uninjured. It was sufficiently evident then that the boiler had yielded to a strong pressure exerted between the two cylinders, which had forced the inner one, which presented the least resistance, inwards, shearing the rivets by the lateral motion of the boiler plates, and completing the opening for the escape of steam, by tearing the iron itself. The committee had two pieces of the iron cut along the edges of the fracture, one in the direction of the rolling of the iron, the other at right angles to this direction. These pieces being reduced by filing to a proper cross-section, were placed in the breaking machine of the Institute, for the purpose of testing their tensile strength. The piece cut in the direction of the grain of the iron broke in the part where it was grasped by the wedges, with a strain of 58,080 lbs. per square inch. As the wedges had marked the surface very deeply, this experiment can only suffice to give the lower limit of its tensile strength, and the committee regret that they could not procure another piece of the iron for the purpose of repeat-

ing the experiment. The piece cut across the grain broke with a strain of 60,480 lbs. per square inch. The iron therefore had a strength to resist tearing very considerably above the average of boiler iron. It however presented a very crystalline fracture, and frequently broke short with the blow of the sledge, which may have been the effect of overheating.

The committee noticed no conclusive marks of overheating upon the iron, but there was a triangular space extending from the bottom of the boiler diametrically opposite the point of introduction of the feed water, to the insertion of the smoke flue above, in which the whole of the deposit which thinly coated the rest of the boiler was burned off, and the surface was clear.

The circumstances connected with the explosion as stated by Mr. Miles, the proprietor, were these: The engine was under the charge of a lad who had always shown himself to be careful and attentive. He was in the habit of filling the boiler with cold water until it began to run from the second gauge cock. The power of the engine was rented out to workmen in the building, and was principally used for turning grind-stones. The safety valve was usually loaded to a pressure of 98 lbs. per square inch, (and the measurements which the committee were enabled to make, were confirmatory of this part of Mr. Miles' statement.) The accident happened about half an hour before the usual hour for the assembling of the workmen in the morning. Mr. Miles was in the house; as the steam was got up earlier than was necessary, he directed the lad to open the fire door, and shut off the draught, which was done, and in about three minutes the boiler exploded. It seems therefore that the explosion took place upon the reduction of the temperature of the boiler. The force must have been tremendous, but the destruction of the building by fire, and the usual vagueness and inconsistencies of eye-witnesses to such an event, prevent any even approximate calculation of it.

That the explosion of the boiler was not caused by a gradually accumulating pressure arising from the continual formation of steam under a fastened safety valve, the circumstances of the case show. The accident having occurred before the time for commencing work, every even plausible motive for such conduct is removed, and it could scarcely have taken place accidentally under the heavy pressure necessary to produce the effects exhibited. Besides, the occurrence of the explosion upon the reduction of the heat of the furnace, appears to the committee perfectly conclusive against this supposition.

That the boiler did not explode from carelessness in supplying it with a proper quantity of water, is rendered probable by the testimony that the gauge-cocks had been shortly before tried, and that a large quantity of water was actually discharged from the boiler at the time of the explosion. The character of the boy who had charge of the boiler, for carefulness, joined with the fact that he was under the immediate inspection of his employer, and the total absence of any conceivable motive for wilful negligence in this regard, should suffice to reject this supposition, if it be possible fairly to account for the explosion otherwise, and the committee believe that a mere glance into the arrange-

ment of the boiler will suffice to show the possibility of such an explanation.

In fact, it appears to the committee hardly possible to devise a boiler of a more dangerous construction. Narrow water spaces, most of them tubular, closed below, and presenting the least advantages for the formation of currents, by means of which water might be continually supplied; the inner cylinder presenting a surface of 90 square feet without a single stay, and exposed to a crushing pressure, so that every change of figure diminishes the resistance to the force of the steam. The experience with locomotive engines shows that it is nearly impossible to keep water in the narrow water spaces which surround their fire boxes, and these spaces are therefore carefully stayed, while we have here an immense surface exposed to the same source of danger, without any support from the inner shell. The steam space of the boiler, allowing for this purpose the space above the upper gauge-cock, was much too small for a stationary boiler, and the water space, including the interval between the two cylinders, the tubes, and the space above the tube-sheet as far as the upper gauge cock, was singularly small when compared with the external dimensions and amount of material of the boiler. In fact the whole cubic content of the water room was but 82,535 cubic inches (about 48 cubic feet, or 357 gallons). Nor is the arrangement advisable in an economical point of view, the surface exposed to the action of the fire, and the heated air being almost entirely vertical, would present itself in a disadvantageous position, and the large clear spaces above the fuel, would permit much of the heated air to ascend freely and escape without communicating its heat to the water at all. The boiler therefore could not have been an economical one, and was most undoubtedly in the highest degree unsafe.

The committee believe that the following is the most probable explanation of the catastrophe: The first effect of the heat would be to expel the water from the water space between the two cylinders and from the tubes (except the centre one). This would be easily and efficiently accomplished in consequence of their small diameter, and closed bottoms, with the exception of that part of the water space where the feed was introduced, where there would of course be kept up a continual current of water. The water then being expelled from these spaces, they would soon become very hot, and since, in this condition, the only effective communication between the heat of the fuel and the water above, would be by means of that in the central tube, it would require a considerable time to heat the whole water up to the proper temperature for generating steam of 90 lbs. pressure, and during this time the walls of the empty spaces would become very hot. When the fire door of the furnace was opened, and the draught shut off, the diminution of the heat would soon permit the water to be forced back by the pressure of the steam above it into the spaces before filled with steam only, and this water coming in contact with the highly heated surfaces, would generate suddenly a steam of great pressure which could not be relieved by the safety valve, and since the action would continue, the boiler must give way, which

it would do, by yielding in the weakest direction, that is, by the crushing inwards of the inner cylinder, the bending of which would diminish the resistance to the pressure, and thus the rivets would give way and the iron tear; the water then being suddenly brought into contact with the ignited fuel, a second pressure would be suddenly developed, which finding its point of resistance on the lower side of the tube sheet, would propel the boiler vertically upwards. That the intense pressure was caused by the return of the water upon a surface of suddenly heated metal is evident from the fact of the explosion having taken place upon the reduction of the temperature of the furnace; and that the tubes and lower water spaces were habitually destitute of water, is evident among other things from the statement made by Mr. Miles to the committee, that when the boiler was filled with cold water as high as the second gauge-cock, the expansion upon heating would carry it up to the upper cock before the steam began to blow off, at 95 lbs., and how much higher he did not know. But supposing the boiler filled to the second gauge-cock with water at 32°, and then to be heated to 346° which corresponds to a pressure of 105 lbs. per square inch, and admitting the commonly received coefficient $\frac{1}{22}$ for the expansion of water for 180°, the level of the water would still fall more than $2\frac{1}{4}$ inches short of the upper gauge-cock. This apparent expansion must therefore evidently have been due to the removal of the water from the lower part of the boiler.

The committee believe, therefore, that there is no evidence in this case of any neglect in the management of the boiler by Mr. Miles, still less of any fault on the part of the maker, either in the materials, or the workmanship. But that the accident is due entirely to the very faulty plan upon which the boiler was constructed, a plan which is not only very ill-judged in regard to economy, but which is, moreover, so dangerous as to render such a boiler utterly inadmissible in practice, and presentable as a nuisance in the neighborhood where it may be placed.

Since this report was written, more specimens of iron from the boiler have been sent to the committee and tested by them.

The iron was crystalised in structure, with fibrous laminæ, and was evidently very brittle, (cold short.)

Only two pieces were in such a condition as to allow of an experiment upon their strength. The first of these, cut with the grain of the iron, broke with a strain of 63,840 lbs. per sq. inch.; the other piece cut across the grain, broke in the wedges with 48,720 lbs. per. sq. inch.

It will be seen, therefore, that although brittle and improper to withstand a blow, the iron was much above the ordinary average of strength to resist a steady pressure.

By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

Philadelphia, June 8, 1848.

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SEPTEMBER, 1848.

CIVIL ENGINEERING.

Report of the Engineer of the Atlantic and St. Lawrence Railroad Company.

Engineer Department, Portland, July 10, 1848.

Hon. W. P. Preble, President Atlantic and St. Lawrence R. R. Co.

Sir,—The period has arrived when it becomes my duty to submit a report of the operations of this Department, during the year ending on the first of July.

I. *Grading and Bridging.*—At the date of my last annual report, there were 47¼ miles of road located, 28½ miles under contract, and a considerable amount of work done. In the month of August last, the remaining portion of the line then located, was let to responsible contractors, and the work soon thereafter commenced.

The grading of the first 11½ miles, with the exception of some heavy work, was finished last year, and the whole, together with the large amount of bridging on this division of the road, was completed in March last.

The second division, 17½ miles in length, was put under contract in November, 1846, but owing to the unfavorable weather during the succeeding winter and spring, only a small amount of work was done. The whole of this work, except one section west of the junction of the Androscoggin and Kennebec road, may now be regarded as substantially finished, nothing of consequence remaining to be done, except the trimming of the slopes and road-bed, giving a total distance graded, for the reception of the track, of 27⅓ miles.

The grading on a portion of the third division, comprising an addi-

tional distance of 11 miles, is rapidly progressing, and more than half the work done. This carries the road to Mechanic Falls.

The excavation and embankment have been laid out for a single track, having a width in excavation of 22 feet and 15 feet on embankment. Where there was a surplus of earth excavation over embankment, it was deposited in the road-bed, thus forming a double track embankment; and in some cases where there was a deficiency of earth in the cuts for embankment, the deficiency was made up by enlarging the cuts for a double track. The aggregate length of double track road is six miles.

The soil of the portion of the road now graded, is much of it of an unfavorable description, it being mostly hard, blue clay, which on exposure to frost and rains assumes an unstable and treacherous character. The slopes are liable to slide, and therefore require close attention and some additional expenditure to preserve and render them permanent. This is particularly the case between Portland and North Yarmouth, and also on sections No. 14 and 15. In several of the cuts, quick-sand of a troublesome character has been encountered, requiring much precaution to give stability to the road-bed. In all cuttings where the soil is of an unsuitable character for road-bed, the earth has been removed from $1\frac{1}{2}$ to 3 feet below grade, and the space filled in with good material. The embankments, also, when formed of clay, are covered with gravel, which is indispensable to a permanent road-bed. As your road advances into the interior, the soil is of a more sandy and gravelly character, and a considerable portion will require no additional ballasting to sustain the track.

In the construction of the larger and more important mechanical structures, provision has been made for a double track. Protection walls are also placed in a proper position to sustain double track embankment. The masonry of Presumpscot Bridge, and other structures which cannot be enlarged hereafter without great difficulty and excessive cost, have been designed for a double track. The masonry of the bridges is formed of the best granite, laid in courses with alternate headers and stretchers, and is of the most substantial character. Nothing has been expended for ornament, but the whole has been planned solely with reference to economy and permanency. In the execution of the work for the Presumpscot Bridge, difficulties of a formidable character were encountered. The site of the south abutment was at a point where the mud and water varied in depth from 3 to 12 feet below low water, and the average rise of tide was 10 feet. The surface of the rock was found to be extremely irregular, and covered with alternate layers of hard and soft earth, in which boulders and logs were imbedded.

The irregularity of the rock and the unfavorable nature of the material covering it, rendered the use of piles for the foundation impracticable; and, for the same reasons, the adoption of a coffer dam, for the purpose of removing the earth and founding the masonry on the rock, would have been attended with delay and great expense.

The plan adopted was, first to remove the earth from the rock, which was done by an under-water excavator, after which to frame

12 inch hewn timber into squares of 3½ feet each from centre to centre, of sticks, by halving and spiking each at their intersection. The first course was framed so as to fit the lowest part of the rock, and, as the successive courses were added, each was made to conform to the surface of rock, as the bearing was increased, till the wood-work covered the whole space for the foundation; after which it was carried up perpendicularly to a point 3 feet below low water, and upon this two courses of timber running in opposite directions, were spiked, upon which the masonry was commenced. Although a portion of the masonry rests directly on the rock, and another portion on a timber foundation of over 10 feet depth, no unequal settling took place during the progress of the work, nor has the least change since been observed in any part of the masonry.

A portion of the protection wall at this point was somewhat disturbed by the pressure of the embankment, which is over 40 feet high, on the soft material at the bottom, but proper measures were immediately taken which prevented any further movement. It has since been completed and incorporated with the wings of the abutment in a permanent manner, and appears of a substantial and durable character.

The masonry of most of the other bridges rests on pile foundation, and was laid below water line by the use of coffer dams.

The main walls of culverts are generally of substantial dry rubble masonry, the wings, parapets, and coping being hammer dressed masonry.

The wood work of the truss bridges is constructed on the plan of "How's patent improved," having cast iron bearings. The plans of this work were prepared with much care, and with reference to the heavy engines and great traffic which will pass over the road. A much larger amount of material was required in the construction of the bridges, than is usual on other roads, and it is so disposed as to give strength and stability to those parts which heretofore have first failed, and more durability to the whole structure. They are arranged for a single track, and such provision made as will permit the addition of a second track hereafter, without any interruption of the traffic of the road, or difficulty in the execution of the work. These bridges should all be cased and protected from fire and exposure to the weather, by tin roofs.

The total length of truss bridging on the portion of the road now graded, is 870 feet, which has cost an average of $17·12 per foot of bridge.

The total length of pile bridging is nearly three quarters of a mile, and the whole is constructed for a double track. The pile bents are placed at distances of from 10 to 15 feet apart, and the distance from the floor of the bridge to the surface of the ground, or bottom of the water, varies from 15 to 50 feet.

A draw has been constructed in Back Cove bridge of 35 feet opening, and is designed to accommodate two tracks. It is formed of four light trusses, which are operated by a rack and pinion, the trusses swinging on hinges. The trusses for both tracks move at the same

moment and by the same power, but in opposite directions; and those of each track approach each other in a parallel position as they recede from their bearings in the bridge, till they reach the wings of the draw, where they are folded together in a recess by a movement similar to a parallel rule. The time required to open or shut the draw is less than two minutes, which is done by one man, making six revolutions with a lever of 11 feet length.

The grading of the first and second divisions of the road being nearly completed, I have prepared the following tabular statements, showing the principal items of work, the number of yards per mile, and the average cost per yard. By contrasting these prices with those for similar work on other roads, the stockholders will be enabled to judge of the economy with which their road has thus far been constructed. It must be remembered, that the cuts on nearly the whole line are of hard blue clay, or indurated earth of other descriptions. Common excavation, by our classification, includes ordinary loam, sand, gravel, or any kind of earth which is not indurated, and the average cost of removing this has been but 9 6-10 cents per cubic yard. The whole has been executed at much less cost per yard than any work of similar character within my knowledge.

On other roads, owing to the high prices of provision and labor last year, a great number of contractors failed, their contracts were abandoned, and the work re-let at an advance of from 10 to 15 per cent. on the original prices; while on your road, the whole of the work under contract, with the exception of a comparatively small amount on one section, has been executed at the original prices, and at a cost below the original estimate.

The bridges, with one exception, have been built by contract, the contractors furnishing all the materials and performing the work at a given rate per linear foot of bridge, and these prices are considered low, if reference is had to the character of the work.

These results must be gratifying to the friends of the enterprise, and are evidences of the ability and energy of the contractors.

The total estimated cost of grading and bridging from section No. 1 to 17 inclusive, was	$368,298
The total expenditure for these items on this part of the line, up to the first of July, is	338,620
Showing an excess in the original estimate over expenditures up to that date, of	$29,678

The cost of the work remaining to be done, will fall short of this excess.

Tabular Statement of Grading and Masonry from Sec. No. 1 *to* 17, *inclusive.*

Sections.		Grading.				Masonry.		
No.	Length in miles.	Earth excavation Cubic Yards.	Loose Rock Cubic Yards.	Solid Rock Cubic Yards.	Embankment haul.	Protection wall Cubic Yards.	Masonry in culvert cubic yds.	Mas. in B. abutm'ts cubic yds.
1	2·12	54,341	1,200	10,241	65,782	13,999	185	1,420
2	0·96	17,140	4,430	454	17,594		436	
3	1·00	39,884		4,213	43,247		661	
4	0·95	96,202			96,202	4,803	472	2,742
5	1·00	28,446		885	28,050		400	
6	1·00	21,142			19,960		780	
7	0·93	16,235			13,842		461	
8	1·00	14,998		200	12,555		300	
9	1·25	21,145		1,190	16,812		354	
10	1·42	18,125	100	1,686	18,677		432	
11	2·50	32,500			10,000	100	257	1,000
12	2·35	62,000			55,000		458	2,000
13	2·40	86,600	100	250	80,000		976	
14	2·48	78,435	614	362	56,400		1,466	
15	1·93	53,000	180	800	53,000		506	
16	2·00	79,642	110	952	79,642	3,972	296	1,393
17	2·25	77,617	1,737	584	80,000	2,260	605	1,574
Total Cubic Yards.		797,452	8,471	21,817	746,763	25,134	9,065	10,129
Average No. of Yards per mile.		28,981	307·6	792·2	27,115	912·6	329·9	367·7
Average cost per Cubic yard.		$0·145	0·24	0·754	0·033	1·116	2·51	4·295

Tabular Statement of Bridges from Section No. 1 *to* 17, *inclusive.*

Description and location of Bridges.	Length in Feet.	Average cost pr. ft. of Bridge.	Total cost.	Remarks.
Pile bridge at terminus,	2233	$ 6·80	$15,184·40	Double Track.
" " " Back Cove,	1519	16·45	24,987·55	" "
Truss " Presumpscot R.	320	20·00	6,400·00	How's pat. sing. track.
" bridges Sec. 11 & 12,	264	17·68	4,667·52	" " " "
" " " 16 & 17,	286	13·40	3,832·40	" " " "

II. *Track.*—The track of the road from Portland to Royal's River, a distance of about 11 miles, was placed under contract in February last, and the work has so far advanced as to permit the cars to run to North Yarmouth. The iron and timber required for the balance of the road to Mechanic Falls, an additional distance of 21½ miles, are contracted for, excepting that portion of the timber required between Danville and the latter place. The road may be opened for business to the junction of the Androscoggin and Kennebec Railroad in September next, and the remainder of the distance to Mechanic Falls, in November next.

The track of the road is formed of pine longitudinal sills, 7 by 11 inches square, embedded in gravel, tied together transversely by oak ties 2½ inches thick, and 6 inches wide, fitted into, and even with the surface of the sill, by a dove-tail joint, and secured with keys of the same description of timber.

The iron is of the bridge pattern, weighing 63 lbs. per yard, and is laid with a continuous bearing on the sills, being secured in its position by claw-headed spikes, chairs, and centre plates. The gauge of the road, or the space between the rails, is 5½ feet.

There is half a mile of double track laid at the terminus, also side tracks leading to the engine house and to the works of the Portland Company.

III. *Depot Grounds, Buildings, &c.*—Contracts were entered into early last year, for the construction of crib-work and the requisite earth filling, to provide a site for the buildings at the terminus, and other depot purposes. This work was mostly finished last year.

A portion of the crib-work has somewhat changed its position, in consequence of the great depth of mud, but it is now rendered permanent and secure. The line of the dock is parallel with the road, the approach to it by vessels made more convenient, and the whole is much improved.

In the month of May last, a passenger building and an engine-house at the terminus, and a building for the North Yarmouth station, were placed under contract. The passenger building is 200 feet long and 75 feet wide, and is designed to accommodate, for the present, both the freight and passenger business at the terminus. It is of sufficient width for three tracks, and two platforms of 20 feet width each. The portion now erected is intended, for the present, to accommodate the several trains arriving at and departing from this station; and it is designed, hereafter, to carry out the building with a suitable front, to the east line of India street, which will furnish the requisite rooms for passengers and offices of the Company.

This addition will make the whole length of the building 250 feet, and allow three tracks in it of 220 feet length each. If greater length than this is hereafter required, it may be conveniently obtained by adding to the eastern end of the building. This building stands parallel to the dock and to the line of the road, the track approaching it on a straight line for the distance of half a mile.

It is conveniently situated for the transfer of freight from the cars to

vessels; and passengers going out or arriving in steamboats, have merely to cross a platform between the cars and the boat.

The location of your road is such at the terminus, that it is parallel with the harbor for the distance of half a mile, and for the whole of this distance, vessels have an uninterrupted approach to the road, where they may receive and discharge their cargoes directly from and to the cars. Such are the facilities, at the present time, that vessels now discharge their lading of iron, timber, and other building materials, at any point within this distance, on the main tracks of the road.

The engine-house is of brick, and is only intended to accommodate the requisite number of engines for the business of the first few years, after which it will be useful for the storage and repair of cars. It is of sufficient capacity to contain six engines, and a turning table of 45 feet diameter. A small addition made to the building, at such time as the business of the road requires it, will give ample room for nine engines, and it will still be of convenient shape and an economical building for other purposes, when superseded by an engine house of the requisite dimensions to accommodate the business of the whole road.

The passenger station at North Yarmouth will probably be finished the present month, and the freight business of that place may be accommodated, for the present, by the use of the building purchased with the lands of the Company at that place, which it is proposed to move to the point required for that purpose.

The plans of buildings required for other stations are matured. The drawings and specifications are in progress, and will soon be submitted for the consideration of the Board.

Two turning-tables have been constructed, which are respectively 25 and 45 feet in diameter. The large table is now in use and operates satisfactorily. The small one is designed for the station to which the cars may run during the coming winter.

IV. *Machinery for the Road.*—Two locomotives have been purchased to provide for the immediate necessities of the road. One has been in use on the road a considerable length of time, hauling gravel, timber, iron, &c. The other will be used for the passenger business till other engines are completed, and will also aid in the transportation of building materials.

There have been ordered from the works of the Portland Company, three engines, six passenger cars, two baggage and mail cars, thirty enclosed freight, ten platform, and twenty earth cars. There are now delivered and in use on the road, two passenger, four platform, and eight earth cars. The work on the engines is progressing, and the builders hope to deliver one by the first of September, one in October, and the third in season for the spring business. Two passenger and all the earth and platform cars are to be finished by the first of September, and the remaining passenger, and all the enclosed freight cars by the first of November.

V. *Surveys.*—A careful survey has been made, during the last year, of the whole country between Paris, (the point to which the final location of the road is made,) and the Province line. The total length

of line surveyed is over 150 miles, which includes the survey of several subordinate routes.

A line was traced, during the last autumn and winter, through the Little and Great Androscoggin valleys, the Ammonoosuc valley, and on both the New Hampshire and Vermont side of the Connecticut valley. Surveys were also made for a branch to Lancaster, and to test the practicability of carrying the main line to that place, through the valleys of Moose and Israel's rivers.

There are several routes by which the boundary line may be reached, and all have been instrumentally examined, except that by the Nulhegan valley, the surveys of which are now progressing. These surveys will be completed the present summer, and the results of the whole will then be submitted for the consideration of the Board.

These routes diverge in the Connecticut valley at a point about 22 miles south of the Province line, and again unite near Lenoxville, in Canada, a distance of about 25 miles north of the boundary.

This required that the Provincial corporation should co-operate with you in the survey of these routes, and I am happy to state, that thus far the surveys have advanced in concert, and will be completed on each side of the boundary at about the same time. When the question of junction shall have been definitely settled, the whole route of your road may be regarded as determined.

The disbursements through this department for surveys and construction up to the first of July, were $454,844·90.

In conclusion, permit me to urge the importanceof completing the road and of opening it for business to Mechanic Falls the coming autumn. The grading will be finished at an early date, and it only remains to obtain the timber and lay the track, to bring into use this additional piece of road. Mechanic Falls is an important point, from which roads diverge in every direction, and to which the trade and travel of the surrounding country will naturally concentrate. By extending it to this point, a large additional trade will be secured to the road, which otherwise will pass through other channels to market.

I have the honor to be, Sir, your ob't servant,

A. C. Morton, *Chief Engineer.*

On the Strength of Materials, as applicable to the construction of Cast or Wrought Iron Bridges, including an account of the Tubular Bridges over the Conway and Menai Straits, &c. By George Buchanan, *Esq.*

(Continued from page 4.)

In the first part of this paper, Mr. Buchanan described, on a former evening, the principle and construction of the High Level Bridge at Newcastle, which is intended to complete the communication by railway between London and Berwick-upon-Tweed. Some inquiry having been then made from the chair regarding the bridge over the Tweed, the only remaining link uncompleted between London and Edinburgh, he had received the following particulars from Mr. Harri-

son, the resident engineer under Mr. Stephenson :—This bridge is to be of stone, and is to consist of 28 semicircular arches, each 61½ feet span, resting on lofty piers, carrying the level of the railway 103 feet above high-water mark, 126 feet above low-water mark, and 135 feet above the deepest part of the bed of the river. The whole length of the bridge, with abutments and wing-walls, is 2140 feet. The 28 arches are divided into two series by a broad pier, 28 feet in thickness in the middle. The piers of the arches are 8½ feet in thickness at the springing, increasing by steps towards the bottom. The bridge will not be completed for 16 or 18 months, but it is intended to have a temporary bridge ready for traffic in the month of July next. This viaduct is a work of great magnitude, and will form, when finished, a striking and imposing structure, and one of the many to which the extension of railways has given rise. While on this subject, he would mention two other remarkable works, recently designed and executed by Mr. Miller on the North British and Ayrshire Railways. The one is the viaduct over the Valley of Dunglass, between Dunbar and Berwick, not far from the once-celebrated Pease Bridge. This viaduct crosses the valley and banks by six semicircular arches, each 60 feet span, and then the deep ravine by a single arch, 135 feet span, and rising 105 feet above the bed of the stream. A large and beautiful model of this structure was exhibited, which Mr. Miller, at the President's request, had allowed to be shown to the society. The other viaduct is that of Ballochmyle, across the Water of Ayr, on the Cumnock Extension of the Ayrshire Railway, and is similar to that of Dunglass in crossing the valley on three semicircular arches, each 50 feet span on each side, but is still more remarkable in crossing the deep ravine in the middle by a single semicircular stone arch no less than 180 feet span, and rising 150 feet above the bed of the stream—a bold and noble design, and which has been executed with complete success, the adjacent rocks furnishing such vast blocks of stone as greatly to facilitate the construction, and to render, indeed, the plan itself practicable. The arch stones are 5 ft. 3 in. deep at the springing, and 4 ft. 9 in. at the crown, and the appearance from below of the stupendous arch rising to such a height is singularly grand and striking. The whole arrangements connected with the quarrying and raising and depositing the stones on the building, by the improved machinery of modern times, have been most efficiently conducted by the contractors, Messrs. Ross and Mitchell, and the simple mode of centering adopted and shown in the Dunglass model is recommended by the advantage of preserving the timbers entire.

The subject of stone bridges opens a wide and interesting field, but extending beyond the limits of this paper. He would, therefore, resume the one more immediately prescribed, namely, the strength of materials, particularly iron, for bridges. Some interesting experiments, which the time on the previous evening did not permit to be shown, were then made on the tensile strength of stone from Hailes and Craigleith quarries. The Hailes stone bore on the square inch 360 lbs., the Craigleith considerably more; and a remarkable effect was observed here after the load had hung for a little: it was suggested by a mem-

ber to give it a slight tap with a hammer, and, on this being done, it immediately snapped asunder, showing the effect of vibration or concussion when the materials are greatly strained in aiding and completing the fracture, a circumstance which appears to throw light on what may sometimes occur by the rapid and violent actions of the trains on railways. The compressive strength of the Hailes and Craigleith stones was then shown, by experiment, to be much greater than the tensile strength; and as it required, indeed, more weight and a more powerful apparatus than could be commanded, these experiments on different stones were deferred to another evening.

The compressive strength on posts or pillars was then considered, and the remarkable effects of the length of the pillar in diminishing its strength. On this subject much light has been thrown by the experiments of Messrs. Hodgkinson and Fairbairn. Pillars or rods were tried of different lengths, from 3 inches to 5 feet, and of different diameters; rods half an inch diameter, with 3¾ inches length, bore 11 tons; but when the length was 7½ inches it only carried 5 tons; when 15 inches long, 3 tons; and at 30 inches only 13 cwt. From these experiments, a general rule may be drawn for different lengths. Taking the strength of cast-iron as formerly given at 50 tons per square inch, this will hold good in pillars till the length reaches five times the diameter, and then it begins to diminish. When the length is ten times the diameter, the strength is reduced in the proportion of 1¾ to 1; with the length at 15 times the diameter, it is reduced as 2 to 1; 20 times as 3 to 1; and 40 times as 6 to 1.

Hence the great advantage in cast-iron, of using hollow pillars or tubes in place of solid metal, whereby, with the same area or section of fracture, the diameter of the pillar is increased, and with it the resistance to flexure, and an increase of strength in proportion to the length. A solid pillar, for instance, 6 inches in diameter, if extended to 7½ feet in length, would be weakened one-half, but if cast hollow, 10 inches in diameter, and $\frac{3}{4}$ inch thick, giving the same weight of metal per foot in length, it might then be extended to 12½ feet, and still possess the same strength as the other. In all these cases a remarkable circumstance was observed in regard to the mode of applying the strain. With the ends of the pillar turned flat, and a flat plate interposed at top and bottom, which is the case in supporting buildings, this was found to sustain nearly three times as much as when the pillar was rounded on the ends, so as to make the force pass directly through the axis, as occurs so frequently in machinery with the connecting rods of steam-engines, and in other cases. The effect of the length of pillars in weakening the strength, was illustrated by a striking experiment with a spiral wire, quite flexible, yet, when set up as a pillar, and tied in the middle laterally, with slender threads, carried a weight of 56 lbs., and would have carried much more, but the moment the threads were cut, the wire gave way by flexure, and oversetting the balance, the weight immediately sunk.

In regard to the transverse strain, he had already explained the nature of this compound action, and particularly the manner in which, under it, the beam becomes exposed at once to the effects of tension

and compression, the one side being distended and the other compressed. On this most interesting and important subject he had still much to say, but would defer it to another evening, as the time was short, and he was anxious to proceed with another part of the paper which had been particularly referred to, namely, the subject of the tubular bridges.

The application of malleable iron had been already used in the shape of tension-rods in cast-iron girders, and was applied, as we have seen, in the high level bridge at Newcastle; but the application of girders constructed of malleable iron alone is a new idea. It has been applied on railways in the case of skew bridges of wide opening and limited depth between the railway and the road; in these cases the girder consists of a rectangular hollow tube, or square box, extending over the whole span, and of such depth as can be attained. These have hence received the name of Tubular Bridges, and have excited much attention since the grand experiment has been determined on, of trying these structures on such a magnificent scale as is now in progress of execution in the crossing of the Straits of Menai by the Britannia Bridge, and the estuary of the Conway by the Conway Bridge, and which form, without doubt, the most remarkable engineering enterprises of the present day. These spots, as is well known, had already been the scenes of vast engineering operations connected with the suspension bridges of Telford, to form the great turnpike road communication from the metropolis to Holyhead, and thence across the channel to Dublin; and when it was determined that this communication should be superseded by railway, it became a matter of most serious consideration how these two openings were to be spanned, keeping in view the new conditions of stability required for railway traffic; and the subject having been submitted to Mr. Stephenson, the engineer of the line of railway, namely, the Chester and Holyhead, he at once rejected the principle of the suspension bridge as inapplicable, owing to the undulations to which it was liable, and which had been proved by practice in a similar bridge for a railway across the Tees, to be both inconvenient and dangerous. How far the principle might have been modified by the introduction of proper ties and braces may be a question; but in a case of such vast magnitude and importance there might still have been risk, and, on the maturest consideration, Mr. Stephenson determined to recommend the simple and bold design of a hollow rectangular tube of malleable iron, consisting of thin plates rivetted together, such as he had already tried with success on a smaller scale upon railway bridges, and which he conceived was the best form for securing not only strength, but sufficient stability and stiffness to prevent any undue oscillations or vibrations. To carry out this plan, the assistance of the first authorities, scientific and practical, on the strength of materials, was called in, and to Messrs. Hodgkinson and Fairbairn the duty was submitted of trying the effect with experimental tubeson a small scale, and finally on a model one-sixth of the dimensions of the bridge, being 75 feet long. Much valuable information was obtained during the progress of these experiments. The first thing observed was the uniform tension of the under side of the tube when

loaded, and the violent compression of the upper side, forming a beautiful illustration of the nature of the tensile and compressive forces already laid down. The former, by its uniform tendency to produce the stable equilibrium, bringing the thin masses into a straight line, the line and position of repose; but the latter, on the contrary, tending to produce flexure in the plates, to push them out of the straight line, and push everything out of joint; so that when the bottom plates remained firm, and retained their form, the top plates became bagged up and puckered like a loose web of cloth. The top plates were, therefore, strengthened, and the addition of another plate to the top increased the breaking weight from 3,700 lbs. to 4,500 lbs.

As it was not so much strength that was wanted on the top plate as stiffness, in place of adding layer upon layer of plates, the idea naturally occurred of forming the top plate into a series of little hollow square tubes running longitudinally the whole length of the bridge, having the appearance, looking endways, of little cells, the effect of which was such, that while the top plates remained firm, the bottom ones now appeared to give way. These being next strengthened, an extraordinary effect was then exhibited when the tube broke, the sides collapsing together, and twisting and distorting the whole fabric in a singular manner, showing that the sides formed now the weak point. These, then, were strengthened and stiffened by numerous ribs of angle-iron running vertically from top to bottom, and at last, by these repeated trials, the strength and proportions of the different parts of the structure appeared to have attained a fair and proper distribution. The strength of the tube, which at first only carried seven times its own weight, was then increased to eleven times, and from these experiments, the strength and proportions of the real design have been calculated, and one of these tubes, as is known, has now been actually constructed on the shore of the Conway, floated by water to its place, and raised to its proper height by the power of two enormous hydraulic rams, one at each end, lifting the gigantic mass, which is 412 feet in length, 15 feet wide, 25½ feet high, and weighing no less than 1300 tons. This is intended for one set of rails, and there is another tube of the same dimensions in preparation to be set parallel to it for the other.

The situation of the structure close to the suspension bridge, and close to the base of the magnificent Castle of Conway, and the effect of spanning the wide estuary of the Conway, were all illustrated by a beautiful drawing, and the nature and construction of the tube or bridge itself, was illustrated by a model which he had himself constructed. The model was composed of only three thicknesses of paper and one of cloth, and the sides were strengthened by thin slips of wood to represent the angle-iron; it was 8 ft. 6 in. long, 6½ inches deep, and 3½ broad, and although weighing only 4 lbs. it carried a weight of 32 lbs. in the centre, without visible deflection.

The dimensions and structure of the bridge he would now describe, from information for which he was indebted to Mr. Fairbairn of Manchester, and, through Mr. Stephenson, to Mr. Edward Clarke, the resident engineer under him.

The sides of the tube, which are 25½ feet deep at the centre, consist of

malleable iron plates, only $\frac{1}{2}$ inch in thickness, rivetted together in plates 2 feet broad and from 4 to 8 feet long, (as was shown in an enlarged view or elevation with cross sections,) adjusted so as that the joints may break band. At the joints, however, the strength and stiffness of these plates is greatly increased by slips of angle or T iron, one of which is laid on the outside of the plate, and the other opposite to it on the inside, face to face, and all the four surfaces strongly rivetted together. The top of the tube, again, consists of two separate horizontal plates, running parallel to one another, 1 ft. 9 in. apart, forming together as it were a ceiling to the tube or tunnel, and an external flooring on the top. These plates are $\frac{3}{4}$ inch thick, rivetted together in breadths of 2 ft. 9 in. thick, and in lengths of 6 feet, and between them there runs seven vertical plates longitudinally, from end to end of the bridge, 1 ft. 9 in. high and $\frac{3}{4}$ inch thick, separating the ceiling from the floor or upper platform, and at the same time uniting them strongly together by rivets and joints, each vertical plate having a rib of angle-iron on each angle, running longitudinally the whole length, by which it is united into one vast cellular mass, consisting of eight separate cells or tubes, 1 ft. 9 in. square. The object of all this strength and distribution of materials is to give the necessary stiffness and strength where the compressive force acts. And on this account the top and bottom plates are merely united by butt joints with covering plates. The whole sectional area of this cellular frame consists of 608 square inches. Lastly, the bottom of the tube consists of a similar frame of cells, but only six in number. The upper plate consists of two layers of plates, each $\frac{1}{2}$ inch thick, and the under one the same; but as these plates are intended to resist tension, and ought to be formed, if it were possible, like a chain, besides being laid in two layers, the plates are arranged so as to break joint, and a covering plate 3 feet long and as thick as the plate, is placed over every joint with sufficient rivets, such that the tearing strain is equal to the tensile strength of the plates they connect. The plates are 12 feet long and 2 ft. 4 in. broad, being the whole breadth of the cell. The angle iron in the bottom cells and plates is rendered continuous by covers.

The top and bottom are united to the cells by strips of angle-iron running the whole length, inside and out; the interior vertical angle-irons at the top and bottom are curved round to increase the strength of attachment, and there are also gusset or angle pieces rivetted on for additional strength. The rivets used vary from 1 inch to $1\frac{1}{4}$ inch diameter, and there are about a quarter of a million in each tube. The holes were made so as to make the rivets fit well, and they were all put in red hot. The sectional area of the bottom frame of cells is 508 square inches.

These are the dimensions in the centre of the tube, but the top plates become thinner towards the ends, where they are only $\frac{1}{2}$-inch thick, and also the bottom plates, where they are reduced to $\frac{1}{4}$-inch each. The side plates again get thicker towards the ends, where they are $\frac{10}{16}$ths thick. The ends of the tube are stiffened with cast-iron frames, and there are also castings in the cells for 8 feet at the ends, and the sides are also greatly strengthened at the ends. The tube was origi-

nally curved on the top 7 inches, and was brought to the straight line by the elasticity of the material as calculated on; showing that with its own weight, 1300 tons, it only sunk 7 inches. The one end of the tube is to be fast in the stone pier or abutment, the other is to be loose to allow of expansion, which has been found quite visible in different states of the atmosphere. Mr. Clarke says that the tube is a sensible thermometer,—half an hour's sunshine at one end, or on the top, will move it laterally an inch and a half, and vertically two inches, and this when the tube is loaded with 200 tons in the centre.

Such are the dimensions and structure of this extraordinary work, and in regard to which, he was happy to say, the trials which have been already made appear to promise every success. A load of 100 tons only sunk the tube 1 inch in the centre. In regard to the calculation of strength he was not able to enter on these at present for want of some of the data, but expected to do so on a future occasion.

The thanks of the Society were voted to Mr. Buchanan for his excellent and instructive exposition; and also to Mr. Stephenson, Mr. Fairbairn, Mr. Clarke, and Mr. Harrison, civil engineers, for communicating the information relative to the tubular bridges at Conway and Menai, and viaduct at Berwick; and to Mr. Miller, C.E., for allowing his elegant model of the viaduct at Dunglass to be exhibited. Mr. Buchanan was at the same time requested to continue his observations, and lay them before the Society at a future time, which request he kindly promised to comply with.—*Proc. Roy. Scot. Soc. of Arts.*

Civ. Eng. & Arch. Journ.

Fares Charged on several of the Railways in England, per Passenger per mile.

We copy from the report lately published, the fares actually charged by a few of the railways per passenger per mile:

	1st Class. d.	2nd Class. d.	3rd Class. d.
Bristol and Birmingham,	2·64	1·75	·94
Eastern Counties,	2·30	1·53	·97
	1·91	1·30	·79
Great Western,	2·74	1·88	
London and North-Western,	2·18	1·45	·91
London and Brighton,	2·63	1·71	1·18
London and South-Western,	2·87	1·89	·96
	2·03	1·43	
Midland,	3·	2·	1.00
South-Eastern,	2·29	1·54	·90
	2·	1·25	1·00
York and North Midland,	2·25	1·75	1·25

Lond. Rail. Journ.

Description of Cars for Conveying Gunpowder on Railways.

It may not be generally known that large quantities of gunpowder

are frequently and safely conveyed by railway, as much as eleven tons in one day, and in the course of a few months above one hundred tons of gunpowder have been carried on the London and North-Western line to Liverpool, Manchester, Leeds, and other places. The wagons in which the gunpowder is conveyed are made expressly for the purpose. There are eight of these wagons on the London and North-Western railway, constructed in accordance with the patent of Mr. Henson. The body of the wagon is formed with sheet iron on the outside; the inside is lined with two-inch plank, between which and the iron outside a thickness of felt is carefully placed. These are screwed together from the outside, so that there is nothing but wood inside; except on the floor, which is covered with sheet lead. The door fits so close with a double rabet, that it is almost air tight, and it is therefore imposible for any fire to get to the powder inside the wagon.

The axles are cased with wood. The comparative absence of the usual noise and vibration in the movement of these powder-wagons, is very remarkable. **Ibid.**

AMERICAN PATENTS.

List of American Patents which issued in the month of June, 1847, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Threshing and Cleaning Wheat, &c.;* Samuel Barley, Keers Creek, Rockbridge county, Virginia, June 5.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the manner in which I construct the shaker, by forming its bottom of fluted boards, and of rollers turning upon pivots, substantially in the manner, and for the purposes set forth; and secondly, I claim the particular manner in which I have arranged and combined the two fan wheels, and the two vibrating boxes, or shoes, operated by means of the vibrating bars, and otherwise constructed and actuated in the manner described."

2. For an *Improvement in Manufacturing Skates;* B. F. Shellabarger, Mifflintown, Juniata county, Pennsylvania, June 5.

The patentee says,—"The nature of my invention consists in casting solid with the runner of a skate, three thin plates for the heel, ball, and toe of the foot to rest upon, and also eyes or loops to attach the straps to for fastening the skate to the foot."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the casting the plates for the foot to rest upon, and the bars to attach the straps to, all solid with the runner, respectively arranged and proportioned substantially as herein set forth."

3. For an *Improvement in Making Candles;* B. F. Shellabarger, Mifflintown, Juniata county, Pennsylvania, June 5.

Claim.—"What I claim as my invention, and desire to secure by

letters patent, is the manner in which I form the candles, point them, and cut them to a suitable length at one operation, by means of the cylinder, piston, wick tube, moulding tube, grooved pulley, axles, and connecting band; the cutter wheel, curved cutter, and conical spiral cutter, combined and operating with each other substantially as herein set forth.

"I also claim the manner of preparing the tallow, or other suitable material for moulding in a cold state, by cutting it into thin slices, previous to placing it in the cylinder, for the purpose of giving equal solidity to the candles, and uniformity of appearance."

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4. For an *Improvement in Smelting Copper Ores;* James Napier, Stockwell, Middlesex county, England, June 5.

Claim.—"What I claim is the application of iron with alkaline substances to the smelting of copper ores, and the decomposing, and disintegrating, by means of water, the product obtained by such application."

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5. For an *Improvement in Fire Arms;* Henry S. North, Middletown, Middlesex county, Connecticut, June 5.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the guard lever with the crotch, by means of the notch in the guard-lever, made back from its axis, and near where the curve of the bow commences, when in combination with the receiver, or magazine, by means of the stud, or finger on the guard-lever, and mortise on the under side of the receiver, or magazine, the whole combined and operating substantially as hereinbefore described."

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6. For an *Improvement in Rotary Steam Engines;* James Black, Philadelphia, Pennsylvania, June 5.

The patentee says,—"The nature of my invention consists in the constructing a steam wheel with a double series of curved buckets, secured to its periphery, closed at their sides, and divided by a central division plate, with the spaces between the series of buckets on each side of the division plate, connected by curved apertures; and the arranging the steam wheel within an enclosing casing, in such a manner, that steam admitted to the buckets on one side of the central division plate, will act directly upon the wheel, by impinging upon the face of the buckets, and descending to the base of the same, will pass through the connecting apertures to the series of buckets on the opposite side of the division plate, and in escaping from between which, it will react upon the face of the buckets, and give additional impetus to the wheel."

Claim.—"What I claim as new, and desire to secure by letters patent, is the double series of curved buckets upon the steam wheel, with the spaces between the same, united as herein described, combined with the steam pipe, by means of the segment, substantially in the manner and for the purpose herein set forth."

7. For an *Improvement in Grinding Mills;* Asa Barber, Stephentown, Rennsselaer county, New York, June 5.

The patentee says,—"The nature of my invention consists mainly in the application of two metallic furrowed surfaces, for the purposes of grinding grains of wheat, corn, coffee, barks, drugs, &c.; being combined in such a way as to dispense with all the ordinary grinding stones now in use."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the conical drum, and lifters, with the grinding cylinder, and concave furrowed bed, substantially as herein described and set forth."

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8. For an *Improvement in Water Wheels;* Uriah A. Boyden, Boston, Massachusetts, June 5.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"Firstly, Fastening conical or bell-shaped rings to the circumference, or outer edges of the rings, or rims of turbine wheels, and reacting water wheels, which the floats are attached to, or making the rings or rims which the floats are attached to, of so large a diameter as to extend outward beyond the outer extremities of the floats, or buckets, and making the part of one or of both of the rings or rims which are outside of the floats, curved, conical, bell-shaped, or such other form, that the distance between them at their exterior edges, or circumferences, shall be greater than at their parts next the outer extremities of the floats, as described above. I do not limit my claim exactly to the width or forms described, but extend it to all forms which are essentially the same as those described. I do not include in this claim the placing bell-shaped rings, around the circumferences of wheels, detached and separate from the wheels; but I claim these adjuncts so attached to the wheels as to revolve with the wheels, or so made as to be parts of the wheels.

"Secondly, Making the parts of the tops of the leading curves at and near the garniture sloping; though I do not confine my claim exactly to the angle of slope described, but extend it to all slopes of any angle, inclination, curvature, and extent, which will in any degree, answer the same purpose."

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9. For an *Improvement in Raising Ice from Ponds, &c.;* Willis M. Cowling, Richmond, Henrico county, Virginia, June 5.

The patentee says,—"The nature of my invention consists in the employment of an inclined endless belt, or chain of slats that passes around two rollers, one placed below the surface of the water, and the other as high as it is desired to raise the blocks of ice; the slats being provided with sharp metal pins, or points, that stick into the blocks of ice, and hold on to them sufficiently to carry them up the inclined plane, and deliver them at top by the passing of the belt around the upper roller."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of elevating blocks of ice from the water, by means of an endless belt, or chain, provided with sharp metallic points, substantially as described."

10. For an *Improvement in Fire Arms;* Edwin Wesson, Northborough, Worcester county, Massachusetts, June 5.

The patentee says,—"The object of my improvement is to discharge two or more gun barrels, (having separate charges,) at one and the same time."

Claim.—"What I claim as my invention, is the afore-described improved mode of combining and connecting several guns, or barrels, so as to cause their charges to be fired by the explosion of the charge in one of them, substantially as herein set forth."

11. For an *Improvement in Snubbing Canal Boats, and Vessels;* Joseph Rowland, Hancock, Washington county, Maryland, June 5.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the attaching to a canal boat, and barge, movable fenders, as herein described, in combination with the arms, levers, ropes, and uprights, as herein described."

12. For an *Improvement in Excavators, or Ploughs;* Henry B. Sommers, Greenfield, La Grange county, Indiana, June 5.

Claim.—"What I claim is,—1st. The above named toothed roller, in combination with the shares, operating in the manner and for the purpose described.

"I also claim the forward cutter, in combination with the wheel, and shares, for levelling the bogs, or turf, in the manner described. I also claim the vertical cutters, in combination with the shares, for separating the furrow from the land border, as described."

13. For an *Improvement in Cutting Files;* Richard Walker, Portsmouth, Rockingham county, New Hampshire, June 12.

The patentee says,—"The nature of my invention consists in constructing a machine to cut two sides of a file at the same time, and by one and the same motion, by pressure on the chisels, instead of a blow by a hammer, the power of pressure being a suspended weight, arranged in such a manner, as to give any required depth of cut in a more regular and uniform way than by a blow, or otherwise."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the weight, cam, slide, and dog, with the carriage, toggle joint, and cutter levers, for the purpose of cutting files by pressure, substantially as herein set forth."

14. For an *Improvement in Sash Machinery;* Jesse Leavens, Springfield, Hampden county, Massachusetts, June 12.

Claim.—"What I claim as new, and desire to secure by letters pat-

ent, is,—1st, The employment of small cutter heads, placed on separate shafts at right angles to the stuff to be tenoned, which enables them to cut with the grain, and also to cut under at the shoulder, and be readily adjustable, the space between the cutters being left free for the tenon to pass through, as set forth, so that by passing the stuff once through, it is tenoned, coped, and franked at one operation, as specified.

"Secondly, I claim the combination of a treadle, with the rotary power, of a mortising machine, to gauge the depth to which the chisels cut, and to tighten the band gradually as the chisels cut deeper, so that the chisels can be gauged, and driven at any elevation within the compass of the machine, by the bands connected with the eccentric shaft, as set forth, and at the same time can be readily worked by manual power, if required.

"Thirdly, I claim constructing the cutter iron in the manner set forth, in two or more parts, having all the cutting edges in the same plane, so that they can be readily separated and sharpened, when made in the most complex figure, and then re-combined in a permanent manner, as set forth."

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15. For an *Improvement in Composition for Currying Leather;* Isaac H. Hershey, Hagerstown, Washington co., Maryland, June 12.

The patentee says,—"To make and prepare the composition, or stuff, to be used on leather, instead of 'dubbing,' I use common rosin, gum asphaltine, common hard soap, tanners' oil, and stale urine, preparation as follows:

"Half pound gum asphaltine, pulverize and mix the rosin and gum asphaltine, and put them into two gallons of good tanners' oil; then take one pound common hard soap, cut fine and put into the oil; then place the whole as mixed, over a slow fire, or heat, stirring occasionally, until the soap is fully melted, or dissolved; let stand awhile until pretty well settled, then pour off carefully, so that the sediment, if any, may remain in the vessel; while warm, add one gallon stale urine, stir well, and when cool it is ready for use."

Claim.—"What I claim as my invention and discovery, and desire to secure by letters patent, is the use of rosin, gum asphaltine, and hard soap, mixed and combined with oil and stale urine, for the purpose and use above stated."

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16. For an *Improvement in Fire Alarms;* D. Tomlinson, and H. S. Hopkins, Brookfield, Fairfield county, Connecticut, June 12.

The patentees say,—"The nature of our invention consists in the putting in action an alarm, similar to that of the common alarm clock, or any other alarm, to give notice of danger, by means of the expansibility of metallic wire passing through the place to be guarded, and connected with said alarm in case of fire, and producing the same effect, by opening the door, or by other movement, within the place to be guarded, by means of a wire, or cord, extending to, and connected

with, the said alarm in case of burglary. The same improvement may be applied to the ringing a large bell, or any other means of giving alarm."

Claim.—"We do not claim as our invention combining levers, cords, weights, and pulleys, with a verge wheel, and bell, to give an alarm, as this has been done in a certain manner. But what we do claim as our invention, and desire to secure by letters patent, is the particular manner of combining and arranging the lever, bar, sword, right angled weighted lever, perforated plate, with the metallic rod, or wire, attached to the said right angled weighted lever, and a fixed object, kept in a state of tension by said weighted lever, and caused to operate on the sword by a change of temperature, disengaging the bar from the lever, and thus causing the verge to vibrate, and the hammer to operate on the bell, by the action of the weight, and verge wheel."

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17. For an *Improvement in Boilers for Culinary Purposes;* James Stafford, Cleaveland, Ohio, June 12.

The patentee says,—"The nature of my invention consists in applying a tube, or tubes to culinary vessels, for the purpose of carrying off the steam or gases downwards into the stove, grate, or range, on which they may be placed, and casting on, or otherwise affixing to either or opposite side, where exposed to the action of heat of said culinary vessels, evaporators or pans, numerous solid projections for the purpose of absorbing and radiating the heat."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of a metallic tube, or tubes, on either side of, or within the body of pots, kettles, steamers, or other culinary vessels, when such tube or tubes shall be used, or intended to be used, for the purpose of conducting off the steam or gases generated within said culinary vessels, *downwards into the stove, grate, or range,* on which they may be placed."

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18. For an *Improvement in Cooking Stoves;* J. M. Thatcher, Danville, Columbia county, Pennsylvania, June 12.

The patentee says,—"The nature of my improvement consists in so arranging the parts of a stove, as to cause the air which supplies the combustion in the fire chamber to pass through a cooking chamber, on its way to the underside of the grate; the back of the said cooking and heating chamber being the front plate of the fire chamber, and the draught which passes around to heat the oven, being made to pass over the top plate of the said heating and cooking chamber."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment, in combination with the fire chamber, of a chamber of sufficient capacity for baking, roasting, or other culinary operation, through which the air to supply the combustion in the fire chamber must pass to be heated, substantially as herein described. And I also claim the arrangement of the air-heating chamber in front of the fire chamber, and on top of the oven, substantially as

described, whereby the top of the oven is prevented from being overheated, and the air-heating chamber can be employed for roasting, baking, &c., as described."

19. For an *Improvement in Engraving Bank Notes;* Benjamin Chambers, Washington, District of Columbia, June 12.

The patentee says,—"The nature of my invention consists in covering a plate with parallel lines of words instead of plain lines, as is done in the ruling machines, but instead of making the lines of words commence regularly, I cause the rollet containing the word or words to turn freely and at random, so as to bring any one of the letters of the word promiscuously to the beginning of the line, so that when a succession of these lines is made close together, the impression from the plate on which they are made has an irregular wavy appearance, caused by the lines commencing with any letter that may accidentally be next the plate."

Claim.—"What I claim as new, and desire to secure by letters patent, is producing lines of characters of any description in an irregular juxtaposition, upon metal plates used for printing, substantially as described, by means of a circular die or rollet turning freely on its axis, so as to commence each line at any part of its circumference that may chance to be next the plate."

20. For an *Improvement in the Fruit Gatherer;* Peter Collyer, Hunter, Greene county, New York, June 12.

The patentee says,—"The nature of my invention consists in providing a quantity of coarse muslin, or canvass, or rating, constructed in such a manner as when completed, will form one sheet, of which the diameter will be twenty six feet, and the circumference eighty-one feet three inches, when used with the middle or centre part raised to a level with the outside edges, thus forming a bag-like or hollow position, for its purpose of gathering fruit."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode described of constructing a new fruit gatherer, for apples and other fruit growing on trees."

21. For an *Improvement in Machinery for making Cop Tubes;* Nathaniel Whitmore, Lynn, Essex county, Massachusetts, June 12.

Claim.—"I claim the bending dies in combination with the spindle, and the cutting dies or mechanism, as arranged and operating substantially as described.

"I also claim the supporting slides or bars, in combination with the bending dies, lip dies, and spindle, the same being arranged and made to operate substantially as described.

"I also claim an automatic combination of a feeding apparatus, cutting dies, bending and breading or lip dies, and spindle, either with or without the supporting slides, or with or without the expelling appa-

ratus or finger, the whole being arranged and made to operate together, in the manner and for the purpose substantially as above specified."

22. For an *Improvement in Air Tight Stoves;* Samuel B. Sexton, Baltimore, Maryland, June 19.

The patentee says,—"The nature of my invention consists in a certain new and useful combination of a ventilator, in connexion with a register, united by a rod in such a manner, that when the register is closed, the ventilator is opened in the same proportion."

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is the manner of combining the ventilator with the register, by means of the vibrating connecting rod or lever inserted into the loops, and turning on the central pivot, for the purposes above stated."

23. For an *Improvement in Cutting Fodder;* John Elgar, Baltimore, Maryland, June 19.

The patentee says,—"The nature of my invention consists in abrading the ends of the fodder before they are cut off, instead of first cutting off the fodder, and then grinding it, as is done in the machine now in use."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is preparing corn fodder for food for cattle by the employment of lacerators in the manner described for abrading the fodder, while held by feeding apparatus, and before the action of the knife, as described; and in combination therewith the knives for cutting it off after it has been lacerated, substantially as described."

24. For an *Improvement in Shaft Tugs for Harness;* Joel L. Hoyt, Deer Park, Orange county, New York, June 19.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is an improved shaft tug for single harness which will be more durable and safe, as herein described, using for that purpose any metallic substance or compound which will produce the requisite safety and durability."

25. For an *Improvement in Cotton Wadding;* Charles Lewis Fleischmann, Washington, District of Columbia, June 19.

The patentee says,—"The nature of my invention consists in having threads, cords, or loose webs, inserted in the surfaces or through the middle of the batting before it is sized, in such a manner that the fibres which are on the surface of the batting become entangled in the threads, cords, or loose webs, and form, when sized and dried, a well combined and strong fabric."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is incorporating with glazed cotton batting, cords,

threads, or loose webs, upon its surface, or inside, as substantially described.

"I also claim the method of glazing cotton batting by wetting the surface with water or any other thin fluid, as described, preparatory to applying the glazing matter, as described.

"And finally, I claim the method of making thick glazed cotton batting, by splitting a thin cotton batting, glazed on both sides, or the equivalent substitute therefor, and interposing between the two halves of such glazed sheets, any desired thickness of cotton batting, or other materials, as substantially herein described."

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26. For an *Improvement in Steering Vessels;* Anthony Shermer, Philadelphia, Pennsylvania, June 19.

The patentee says,—"The nature of this invention and improvement consists in so connecting the bow and stern rudders by means of chains, rods, ropes, or other suitable connecting links, crossed and attached to arms, tillers, or levers, inserted into the rudder heads, or to the peripheries of wheels affixed thereto, so that when the stern rudder is turned towards either side of the vessel, the bow rudder will be caused to turn simultaneously to the same side and at the same angle with the line of the kelson—the action or resistance of the water against one of the rudders in its angular position being counterbalanced by the pressure of the water against the surface of the other rudder—the force or pressure of the water being transmitted from one rudder to the other, by the connecting links, arms, or levers aforesaid; by which mode of connecting the rudders, a perfect equilibrium or balance of forces will be produced—the balancing or turning point of the vessel being equi-distant between the rudders, when the rudders are of the same area, or size; rendering the management of the rudders quite easy in comparison with the old mode of disconnected rudders; and putting it in the power of the helmsman to control the direction of the vessel, when accidentally driven stormwise, in which case it is well known that it becomes very difficult to change the position of the rudder, as ordinarily arranged and operated."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is connecting the bow and stern rudders of vessels by an endless chain, or by separate chains, crossed between the rudders, so that by turning one rudder in one direction, the other rudder will be caused to turn simultaneously towards the same side of the vessel, forming the same angle with the vertical longitudinal plane as above described, for producing the effect herein stated; whether the chains be arranged in the particular manner above stated, or in any which is substantially the same, and by which analogous results are produced."

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27. For an *Improvement in Spark Arresters;* James A. Cutting and George Butterfield, Boston, Suffolk county, Massachusetts, June 19.

Claim.—"What we claim as our invention, and desire to secure by

letters patent, is the double extinguishing cap, placed over the chimney, combined and operating with the cylinder, conical thimble, lining, wells, and pipes, substantially in the manner and for the purpose herein set forth."

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28. For an *Improvement in Musical Instruments;* U. C. and Charles F. Hill, City of New York, June 19.

Claim.—"What we claim, and wish to secure by letters patent, is, first, combining in musical instruments, cells, or chambers, (open at one or both ends,) with strings, or reeds, or springs, or tuning forks, substantially upon the principles and for the purposes above set forth.

"We claim also the manner of sustaining or suspending the forks used for the high notes, as described. We also claim using hard points upon the hammers used to strike the high notes.

"We also claim the employment of metallic springs, of the character described, in conjunction with tuning forks, in a musical instrument, substantially in the manner described. We also claim the employment of a rack, intervening between the sounding board and said metallic springs. We also claim the peculiar mode of constructing the forks for the high notes, giving them such relative proportions in the shaft (or stem) and prongs, as to bring out the sounds, all in the manner described."

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29. For an *Improvement in Tanning Morocco;* Lewis C. England, City of New York, June 19.

The patentee says,—"The nature of my invention consists in the continuous application of heat, by fire or steam, to a tanning tub of a certain construction hereinafter described, and to the tanning liquor while in the tub, so as to keep the tanning liquor at the necessary and proper temperature, while the hides or skins and liquor are together in the tub, and in applying to the tanning tub a dasher, to keep the hides or skins in motion or circulation in the liquor, while the heat is applied to the tub or liquor."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of arranging and employing the dasher, so as to operate on the surface of the tanning liquor, and thereby to keep up gentle circulation thereof, for the purpose set forth."

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30. For an *Improvement in Harness Buckles;* Abel B. Bull, Westmoreland, Oneida county, New York, June 19.

The patentee says,—"The nature of my invention consists in combining with the metallic frame, attached to the hame, a jointed lever tongue in such a manner, that as the draft is applied to the trace, it presses against a cross bar of the jointed tongue, and causes the rear end to move *inward* and the forward end to move *outward*, and to act as a lever in regard to the position or the tongue, so as to hold it firmly in position in the aperture of the trace—the tongue being susceptible of disengagement from the trace in an instant, by simply re-

versing the movement of the rear end of the lever, in order to shorten or lengthen the traces, or alter the position of whatever article it is applied to."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the buckle fastening—that is to say, making the rear end of the buckle in such manner, with reference to the position of the tongue, as will hold the tongue firmly in position by the leverage of said rear end, the parts being constructed and arranged in the manner described."

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31. For an *Improvement in Measuring Cloth, &c.;* Addison Smith, Perrysburg, Wood county, Ohio, June 19.

The patentee says,—"The nature of my invention consists in applying a thumb piece on a level with the counter on which the yard or other measure is marked at the end of said measure, so that as the thumb piece is depressed every time a yard is measured, it moves a hand with which it is connected by proper gearing around the face of a dial, indexed so as to show the number of yards measured."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a movable thumb piece at the end of a long measure, substantially as described, connected by proper machinery, with a movable index, so as to register the lengths measured."

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32. For an *Improvement in Ploughs;* James Walker, Belle Fountain, Logan county, Ohio, June 19.

The patentee says,—"The nature of my invention consists in the method of widening the plough by moving the heel of the mould board, and bracing it by a bolt through the plate share, so that when it is new laid it can be carried out, and as it wears away, it can be gradually contracted, thus presenting the best possible combination of parts during the whole wear of the plough, and also affording greater facility for taking a wider or narrower furrow."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the mould board with the land side and plate share, substantially in the manner and for the purpose set forth, so that the plough can be made wider or narrower at pleasure."

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33. For an *Improvement in Cutting Straw;* William Lewis, Edgefield Court House, South Carolina, June 19.

The patentee says,—"The nature of my invention consists in placing the knives upon the driving wheel in an oblique position to the axle thereof, and the combining the same with the rest and feeding rollers. placed at such an angle with the straw box, as to give to the knives an oblique drawing cut across the fibres of the straw."

Claim.—"What I claim as new, and desire to secure by letters pat-

ent, is the securing the knives upon the driving wheel in an oblique position to the axle thereof, and combining the same with the oblique rest and feeding rollers, for the purpose of giving a drawing longitudinal cut upon the straw, substantially as herein set forth."

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34. For an *Improvement in Forming Brick;* C. H. Preston, City of New York, June 19.

The patentee says,—" My improvements consist in making bricks in two, three, or more parts, set and burned together in such a manner as to result in producing indentations and projections that alternately interlock and counterlock into each other, so as to furnish a continuous bonding of the one, two, or more projecting parts of each brick so made into the corresponding indentations of the next bricks, for which improvement I seek letters patent."

Claim.—" What I claim as new and of my own invention, and desire to secure by letters patent, is the making and burning solid bricks, of two, three, or more parts, so placed together as to interlock and form bonding when put in use, substantially in the form described."

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35. For an *Improvement in the process of making Photographic Pictures and Portraits;* W. H. F. Talbot, England, June 26.

Claim.—" I claim as my own invention and discovery, First, the preparation of iodized paper, as above described, which is not itself sensitive to light, but serves as the basis of all the subsequent operations. Secondly, the employment of gallic acid, in conjunction with iodine and the salts of silver, to render paper extremely sensitive to light. The gallic acid not having been used in photography, previously to my discovery. Thirdly, it was not known previous to my discovery thereof, that paper would be impressed with a latent or invisible photographic image. I claim this as my own discovery, and likewise the means of rendering the image visible at pleasure, namely by washing the paper, in the manner described, with galls of nitrate of silver, or with any other chemical liquids which act upon those parts of the paper only, which have been previously acted upon by light. Fourthly, The using hot or boiling substances of the hyposulphites in order to give increased whiteness to Talbotype photographic pictures, and at the same time make them exceedingly permanent. Fifthly, The waxing Talbotype negative pictures, in order to make them transparent and thus to facilitate the obtaining positive copies therefrom, the said pictures having been previously whitened by immersion in the hot solution of hyposulphite, as last mentioned."

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36. For an *Improvement in the Steam Pile Driver;* James Nasmyth, Patricroft, Lancaster county, England, June 26, (in England, September 17, 1846.)

The patentee says,—" The principal feature in this my invention consists in the first place, in the employment of the pile which is about

to be driven, for the support of the pile-driving part of my apparatus which being of considerable weight, consisting as it does of the cylinder, constructed like that of a common single acting steam cylinder, a hammer block or monkey, which is a heavy weight attached to the piston rod of the steam cylinder and a cylindrical or other formed case, which is attached to the lower end of this cylinder, and acts as a guide to the monkey and encloses the head of the pile on which it rests; these together weigh about three tons (more or less) and very importantly aid the driving of the piles by predisposing it to penetrate into the ground.

"The second feature of novelty consists in the application of the direct acting steam hammer to the driving of piles.

"A third feature of my invention consists in the manner in which I cause the pile, while it is being driven, to become as it were part and parcel of the machine. A fourth feature of novelty in this my invention, consists in the peculiar manner in which, by means of a jointed steam pipe, I am enabled to convey the steam from the boiler to the cylinder, at whatever position the cylinder may be with respect to the boiler."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, firstly, the employment of the pile to be driven as the foundation or base on which to rest my pile-driving apparatus. Secondly, the manner in which I secure and guide the pile in its descent by its temporary attachment to, or connexion with, the driving apparatus and upright frame work of the machine. And thirdly, I claim the combination of the movable engine with the boiler, by means of jointed steam pipes, capable of accomodating themselves to the varying position of the machine during the descent of the pile, substantially as herein described."

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37. For an *Improvement in Cutting Round Tenons on the Ends of Spokes;* John McCune, Senecaville, Guernsey county, Ohio, June 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before-described mode of cutting round tenons on the ends of the spokes of carriage wheels by means of an apparatus constructed as described, suspended to the end of each spoke, during the operation of cutting the round tenon thereon."

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38 For an *Improvement in Harvesting Machines;* John Dunlap, Geneva, Walworth county, Wisconsin, June 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the swinging brush, swinging on the shaft of the reels in the inside of the reels, as described, and in combination with the stationary brush for the purpose, as herein set forth and described."

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39. For an *Improvement in Railroad Coal Cars;* Ross Winans, Baltimore, Maryland, June 26.

The patentee says,—"The principle of my invention by which I

am enabled to attain these important ends consists in making the body, or a portion thereof, conical, by which the area of the bottom is reduced, and the load exerts an equal strain on all parts, and which does not tend to change the form, but to exert an equal strain in the direction of the circle. At the same time this form presents the important advantage, by the reduced size of the lower part thereof, to extend down within the truck and between the axles, thereby lowering the centre of gravity of the load."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the body of a car for the transportation of coal, &c., in the form of a frustrum of a cone, substantially as described, whereby the force exerted by the weight of the load, presses equally in all directions, and does not tend to change the form thereof, so that every part resists its equal proportion; and by which also the lower part is so reduced as to pass down within the truck frame and between the axles, to lower the centre of gravity of the load, without diminishing the capacity of the car as described."

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40. For an *Improvement in Trusses;* Albert G. Bartlett, Oxford, Butler county, Ohio, June 26.

The patentee says,—"My said invention consists of a steel main spring, which surrounds the body, to which is attached an abdominal corset, and two small springs, one of which supports the perineum by means of an oval pad to which it is attached; the other creates a pressure, by means of a wooden block applied to the abdominal rings, inguinal canal, or other parts that may be lacerated in cases of hernia."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar form of the main spring, as a whole, and, in combination with this form of spring, I claim the form of the inguinal block, and the hernial spring, as above described, and also in combination with this form of spring, I claim the corset substantially as described.

"I also claim the mode of attaching the perineal pad with its spring, so as to allow of the longitudinal motion of the spring, while the pad retains its position, so as to create a constant pressure upon the perineum, during the different motions of the body."

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41. For an *Improvement in Stuffing Horse Collars;* Wade Haworth, City of New York, June 26.

The patentee says,—"The nature of my improvement consists in an apparatus by which the collar can be stuffed, crooked around the block or former on which it is shaped."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the block and stuffing apparatus, consisting of the stuffing board, rods, and clamps, or other analogous device, by which the collar can be stuffed and formed into shape around the block at the same time, substantially in the manner and for the

purpose set forth; the whole operation of stuffing and forming being completed in one machine as herein described."

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42. For an *Improvement in Rotary Steam Engines;* Mahlon Gregg, Philadelphia, Pennsylvania, June 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I have arranged and combined the apparatus for governing the steam valves, and reversing the motion of the steam engine; said apparatus consisting of the cam wheel, the valve slide, the two valves, and the two shifting inclined planes, these parts being combined with the engine, and operating substantially in the manner and for the purpose made known. I do not claim the general manner in which I construct my engine, the steam chamber, and the pistons, being similar in their operation to those used in other rotary engines; but I limit my claim to the particular arrangement and combination of the parts above designated, by which I obtain the ends of governing the admission of steam, and of reversing the motion of the engine, in a manner which I believe to be new, and which is convenient, simple, and efficient."

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43. For an *Improvement in Elevating Water;* Daniel Winder, Hagerstown, Washington county, Maryland, June 26.

The patentee says,—"The object of my invention is to raise water by atmospheric pressure, above the height due to the pressure of one atmosphere, and the nature of my invention consists in connecting the lower part of an air tight receiver, placed in the lower part of a well, with a pump placed more than thirty-two feet above the back of the water in the well, by means of a pipe provided with a two-way cock, that the pump may communicate with the receiver, or with the atmosphere, which pump communicates with another air tight receiver, above it, the top of the said upper receiver being connected with the top of the receiver in the well, by means of a pipe, and the lower part thereof, by means of another pipe, with the tank or tanks above it, into which the water is to be raised. The tube which connects the pump and lower receiver is exhausted, that the water from the lower receiver may be forced up by atmospheric pressure, to the height due to the pressure of one atmosphere; the two-way cock is then turned, to close this communication, and open the pipe to the atmosphere, for the purpose of drawing in air, and compressing it in the upper receiver, which being in connexion with the top of the lower receiver, the elastic force of the air acts on the surface of the water in the lower receiver, to force it up to the height of the pump; so that, re-turning the two-way cock, to re-establish the communication between the pump and lower receiver, the water will be forced up into the pump, and thence transferred to the upper receiver, from which it will be forced up the delivery pipe, by the elastic force of the compressed air."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the lower receiver placed in a well or other reservoir of

water, in combination with the pump placed more than thirty-two feet above the level of the water in the well or reservoir, and with the upper receiver; the pump and lower receiver being connected by means of a pipe, provided with a four-way cock, or other valve, so that the pump may connect with the receiver or the atmosphere, and the two receivers being connected by means of an air pump, that the air forced into the upper one by the pump, may act on the surface of the water in the lower receiver, and force the water up to the pump, to a height greater than is due to the pressure of one atmosphere, as herein described."

List of American Patents which issued in the month of September, 1842, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Moulding Brick;* Alfred Hall, Cleveland, Ohio, September 3.

The patentee says,—"The nature of my invention consists in constructing a moulding machine, to be attached to a common tempering tub, with revolving knives of the usual construction, from which the mortar is conducted directly into the moulds, into which it is forced by the press; to this machine an apparatus is affixed for removing the moulds, and when obstructed by stones, &c., to relieve them therefrom."

Claim.—"What I claim as my invention, and desire to secure by letters patent, are the segment slides, operated on by springs, in combination with the platen and hopper, constructed and arranged as herein set forth.

"I further claim the combination of the carriage, suspended at its rear end with the connecting rods and shaft, for freeing the machine from obstructions, substantially as before specified.

"Lastly, I claim the construction of the carriage, so as to free itself from dirt, that is to say: the pivots and studs for steadying the carriage, the slatted top and railway set off from the carriage, &c., and in combination therewith, the movable carriage, constructed and operated as herein described."

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2. For an *Improvement in the Cotton Press;* Robert Harding, South Berwick, York county, Maine, September 3.

Claim.—"I do not claim the application of the right and left hand screw, to operate the two pairs of toggle joints as above described; nor do I claim the manner of operating two pairs of toggle joints by horizontal pitmen, connecting to a central movable piece; but what I do claim, and desire to secure by letters patent, as my invention, is the manner of combining the toggle joints, moved by a right and left handed screw, operating on the movable centre piece, with the toggle joints moved by the horizontal pitmen, constructed and operating as above described."

3. For an *Improvement in Fire Engines;* Joseph Briggs, Jr., St. Louis, Missouri, September 3.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the combination of the partitions with the pipes as described."

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4. For an *Improvement in Forming and Using Spikes, Brads, &c.;* James Buckelew, Spottswood, Middlesex county, New Jersey, September 3.

The patentee says,—"To the lower or entering ends of my nails or spikes, which I make flat, like a firmer, or chisel, I give a slope or chamfer, resembling that ordinarily given to firmers, leaving them flat, or nearly so, on one side, and giving them a bevel on the other.

"When they are intended to be driven into soft wood, the bevel or bend is to be greater than when they are to be driven into hard wood. In using these spikes or nails, a hole is to be bored into the wood into which they are to be driven, to such a depth as it is desired to drive them without their beginning to clinch; and when driven beyond this point, the chamfer and bend, or the chamfer alone, or the bend alone, which they have previously received, will cause them to curve round, and to clinch themselves in the wood in any desired degree."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of using the spikes, nails, or brads, which I denominate self-clinching, and to which I give a determined amount of chamfer, or of bend, or of both combined, so that they shall begin to clinch when driven into wood, either with or across the grain, the wood being bored for their first entrance, to the depth to which it is desired they should reach without clinching, and there made to turn by the form given to the spike itself, without its being necessary to aid it by the insertion of a plate of iron, or any other analogous device."

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5. For an *Improvement in Railways;* William Emmons, City of New York, September 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application and use of metallic plates or wedges, for the purpose of causing the spikes, used for securing the iron rails or chairs, or other parts of railroads, to be clinched in manner above described, and for other purposes."

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6. For an *Improvement in Locomotive Engines;* Robert L. Stevens, City of New York, September 3.

Claim.—"What I claim as my invention is not the general application to the purposes of machinery, of the principle of connecting wheels by adhesion, as above described, but the manner of adapting it to a locomotive engine, by means of a spring, and by which the advantages above named may be secured."

7. For an *Improvement in Saw Mills;* D. V. Thomas, Richfield, Otsego county, New York, September 17.

The patentee says,—"The nature of my invention consists in an apparatus for setting and gauging the log by a slide, which is moved by running back the carriage in a manner hereafter described."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the lever, in combination with the graduating lever, hand and ratchet wheel, for the purpose and in the manner herein set forth."

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8. For an *Improvement in Portable Baths;* Lucien E. Hicks and Thomas Minor, Middletown, Connecticut, September 17.

The patentees say,—"The nature of our invention consists in constructing a portable bath, for the purpose of creating and applying to any part of, or to the whole surface of, the body, the vapor made from the articles, and in the manner hereafter mentioned."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the covered chair, constructed with a circular iron hoop, having attached to it joints for adjusting the curtain, and with iron rods enclosing the sides of the chair, there being a door on one side, opening to the heating apparatus. Also, a perforated metallic plate, beneath the seat, thereto attached, for the purpose of admitting, and for reflecting the product of the heating apparatus, and likewise a conductor to the feet, in combination with the metallic fountain and tubes, for distributing the fluids, with the heating and evaporating apparatus, constructed with a reservoir for cold water, and a cover containing two divisions, one for burning alcohol, and the other containing materials to be volatilized, or sublimed, with an evaporating pan above these; the whole being constructed and operating as above described."

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9. For an *Improvement in Hinges and Fastenings for Window Blinds;* William Baker, Utica, Oneida county, New York, September 17.

The patentee says,—"The nature of my invention consists in connecting the window blind fastening with the lower blind hinge, by adding to the hinge a latch, or hook, by which the blind is fastened and held, without any fastening on the back side of the blind, or on the wall of the house, and in adding certain other improvements, by which the hinge is strengthened and improved."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the connecting the window blind fastening with the hinge, either by the use of the latch, made as a double fastening, that is, to fasten the blind, both when closed and when open, or when made to fasten the blind when open only; or by the use of the hook on the back of the hinge, for fastening the blind open as described."

10. For an *Improvement in Bee Hives;* Jesse W. Davidson, Rome, Richland county, Ohio, September 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the upper or swarming box, and its small honey boxes, with the collateral hive boxes below, constructed and arranged substantially as described."

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11. For an *Improvement in Stoves;* George Nelson, Boston, Massachusetts, September 17.

Claim.—"Having explained my invention, I shall claim forming the upper part of the fire chamber, converging as set forth, in combination with the vertical partitions, connecting the fire chamber (so constructed) with the external casing, by which arrangement of the above parts, air, to be heated, is brought into contact with a greater extent and degree of warming surface, than would be obtained were the fire chamber continued vertically to the top plate of the apparatus as heretofore described."

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12. For an *Improvement in Pumps;* Henry Rodgers, Moravia, Cayuga county, New York, September 17.

The patentee says,—"The object of my improvement is to cause one pump to serve for the raising of two kinds of liquid from a cellar or other apartment, containing barrels or other reservoirs, having in them the kinds of liquid which are to be raised and delivered in a store, or bar room, or other place where they may be wanted, through tubes, without the liquid passing through, or into the body or main cylinder of the pump.

"The body of my pump consists of a metallic cylinder, of such capacity as may be required, and this is furnished with a piston, the rod of which extends downwards through the lower end of the cylinder, and is worked by a lever under the counter, or in any other convenient situation.

"From the head or cap of the upper end of the main cylinder, ascends a tube, which enters the side of a metallic faucet, through an aperture therein, and which said faucet is open at the top, and from two sides of which last mentioned cylinder descend two tubes, which pass through the caps of the first mentioned cylinder, and thence one to pass through the floor, and are to be connected respectively with the barrels or other vessels, cisterns, or wells, from which the liquors or other liquids are to be raised. In the upper end of the faucet there is inserted a spigot, or key, which is to be turned like that of a common cock, and which, by the position it is made to occupy, will determine the kind of liquor or other liquid to be drawn, and direct its discharge into the vessel which is to receive it. To the lower end of the said fount, which is also open, is firmly attached a tubular glass, also open at both ends, below which is a detached movable tubular glass or other vessel, closed at the lower end, and placed upon a movable stool, with a spiral wire spring bottom, by which the upper end of this tube, which is open, is

or may be pressed up against the lower end of the tube above, so as to make the joint air-tight, and into which last mentioned tubular glass or other vessel, the liquor, water, or other liquid, raised by the pump, is to be discharged, which may be moved when filled, or when it has received as much of the liquid as is desired."

Claim.—"Having thus fully described the nature of my invention, what I claim as new, and desire to secure by letters patent, is the manner in which I raise the liquor, water, or other liquid, through the tubes, without its passing through or into the cylinder, in which the piston is worked, by means of exhausting the air contained in the other vessels in close coaptation with the lower edge of the tubular glass, and thereby causing the liquor, water, or other liquid, to rise up the said tubes, and discharge itself into such tumbler, or other vessel, enabling the piston to be worked in oil, and thereby saving it and the inside of the said cylinder from corrosion, and the liquor, water, or other liquid, raised, from the impurities necessarily engendered or secreted in all other pumps. The whole apparatus being constructed and operating substantially as herein described."

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13. For an *Improvement in Bridles for Horses;* John C. Smith, Brookhaven, Suffolk county, New York, September 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing and arranging the blinders, in combination with the curved braces attached to the top of the head stall, and the use of the curved braces as applied to the other description of blinds.

"I likewise claim the apparatus for sustaining the ears of the horse at any required angle, whether constructed as described, or in any other mode substantially the same, in combination with the head stall and curved braces, attached to the blinders as described.

"I also claim the manner of adjusting the ends of the reins, to correspond with the carriage of the horse, by means of strap and buckle, as described."

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14. For an *Improvement in Making Wigs, Frizettes, &c.;* F. Deville, Baltimore, Maryland, September 17.

The patentee says,—"In my improved wigs, I dispense entirely with the ordinary spring frame, and substitute therefor steel springs, which I make out of wire, of about the size of that used for common sized pins. These wires are each about six inches long, and they are to be flattened by hammering, and to be bent into a form resembling that of the letter U, and brought to a good spring temper. Four springs of this size and kind, I find sufficient to cause a wig to fit closely to the head. In forming the wig, the springs are to be so arranged as to cause them to act upon the outer edge of the foundation or tissue, which constitutes its lining, so as to draw it closely all around its edge, without the exertion of any direct pressure by the springs upon the head itself, their action being entirely lateral."

Claim.—"What I claim as new, and desire to secure by letters pat-

ent, is the employment of four or any preferred number of springs, formed and operating substantially in the manner herein set forth, and applied to the foundation or lining of a wig, so as to cause the same to bind around the head, and effectually to retain it in place, and by which I dispense entirely with the metallic spring frame, which has heretofore been generally employed; the arrangement of such springs being substantially the same with that herein set forth and represented.''

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15. For an *Improvement in Shingle Machines;* Alex. H. Hart, Chagrin Falls, Cuyahoga county, Ohio, September 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lever, stirrup, and foot, tooth wheel, metallic levers, and upper and lower carriages, for the purpose of feeding the machine in the manner described. The construction of these parts, or the combination of the screw wheels and racks, the tooth wheel, and foot, or of any other parts separately, is not claimed."

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16. For an *Improvement in Washing Ores;* Dexter L. Dauvergne, Clarkesville, Habbersham county, Georgia, September 17.

Claim.—"I am aware that machines for various purposes have been made with a vertical shaft, having arms or agitators projecting from it, and revolving within a casing, and therefore I do not claim this as my invention; but what I do claim, and desire to secure by letters patent, is the combination of the conical shaft, with agitators or arms projecting from it, in combination with the outer conical case, provided with holes, and plugs or pins, to let out the water as the washing progresses, and these, thus combined. I further claim, in combination, the cup at the bottom of the conical case, which receives the mercury for forming the amalgam; the whole being constructed and arranged substantially as herein described."

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17. For an *Improvement in Ploughs;* Hiram L. Norton, Granville, Washington county, New York, September 23.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the arrangement of the two rollers on the mould board, in the manner, and for the purpose set forth, or in any other mode substantially the same."

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18. For an *Improvement in Pumps;* William L. Jacobs, Lancaster, Pennsylvania, September 23.

The patentee says,—"The main improvement I have made, and for which I solicit letters patent, is enclosing the vibrating beam and axle, and the upper ends of the connecting rods of the valve boxes, in a tight water box in which they work, and into which the water is raised, secure to the upper ends of the cylinders, having an air vessel

and pipe, of the usual form and construction, attached to said water box. Grooves are formed on the under side of the water box, corresponding, in size and shape, with the upper ends of the cylinders inserted therein. Similar grooves are formed on the upper side of the box, into which the lower ends of the cylinders are inserted. Suitable packing is inserted into these grooves, to render the joints tight. The cylinders are held firmly between the boxes, and in the aforesaid grooves, by a screw bolt, or bolts, which has a head on the upper end, and a nut on the lower end."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the pump with the axle and vibrating beam, to which the pistons are attached, arranged inside the water box, and working therein as described, in the manner and for the purpose herein set forth."

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19. For an *Improvement in the Hydrostatic Pump;* Robert G. Eunson, City of New York, September 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the above mode of pumping the water and air from the condensers of steam engines, viz: By using the pressure of steam in place of the piston, in manner described: by a pump consisting of two barrels of unequal height, the water in the lower being pressed upon by the steam, either by the exhaust from the cylinder, or by the steam direct from the boiler, in combination with the float, chains, shafts, counterpoises, valves, &c., in manner described, or in any other substantially the same, and also the cut off, viz: opening and shutting the throttle valve so as to prevent jarring, by means of the curved lever being acted upon by a lever and slide, and this lever acted upon by the rod, spring, catches, and slide, in manner described, or in any other substantially the same, either as applied to my pump, or for the common purposes of a cut off."

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20. For an *Improvement in Tailor's Shears;* Thos. J. Sloan, City of New York, September 23.

The patentee says—"The nature of my invention consists in adapting the upper bow to the thumb, so that it shall have a more equal bearing than shears now in use, and in constructing the lower bow so as to swivel as the fingers open and shut, the joint being so formed as prevent the edges of the shears from shaving each other."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the so forming the upper bow, and crooking the shank of the shears, that the thumb can have a bearing its whole length upon the lower section, parallel to the blades, in the manner herein described.

"I also claim the construction of the lower bow, so as to swivel in the shank, having a rest under it, in the manner, and for the purpose above set forth. I further claim the forming a steady fulcrum for the blades of the shears, by means of a socket joint, bearing upon the two rings, constructed and arranged as specified."

21. For an *Improvement in Composition, for rendering Wood, &c. impermeable to Water and Dampness;* Charles Lyon, City of New York, September 23.

The patentee says,—"The nature of it consists in applying to a box, prepared for the purpose, a composition that will not only coat the surface, but also saturate the substance of the wood, and thus prevent the passage of water.

"Take six pounds of coal tar, half pound of gum shellac, and one pound of rosin, melt them together, and apply the composition to the surface of the wood or other material, to be rendered impermeable to water. To impregnate the wood with it, I generally apply a hot iron, not so hot as to burn it, and rub it in; by this means the composition penetrates entirely through an inch board."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the composition above described, (or any other substantially the same) with the dry plaster, to render a box, chest, or any other thing, impervious to air, water, and dampness; the said composition being applied to any or all sides of a double or triple box, and the dry plaster packed between, as described."

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22. For an *Improvement in Spark Arresters;* Samuel G. Brown, Henrietta, Monroe county, New York, September 30.

Claim.—"I do not claim merely the peculiar arrangement as represented, but I claim the principle and parts illustrated in the following words, to wit:—I claim as my invention, and desire to secure by letters patent, the method of extinguishing sparks by means of cylindrical or circular screens, fixed and made to revolve in smoke flues, so constructed as to contain, each, a portion of water, or carbonic acid gas, into which a part of the screen is immersed, as above described; also the method of producing or increasing the draught in *furnaces, flues, and stacks,* by exhausting them of heated *air, smoke, &c.,* by means of pumps, as herein described; also the making of apertures in the lower, or bottom part, or parts, of the cylinders of said exhausting pumps, which apertures lead into boxes or chambers, attached to their cylinders, into which the ashes, &c. that settle in said cylinders, will, by the action of their pistons, be caused to pass as described."

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23. For an *Improvement in the mode of cutting, &c. the Sails of Vessels from rolls of canvass;* John Dominis, a citizen of the United States, now residing in the Sandwich Islands, in the Pacific Ocean, September 30.

The patentee says,—"As sails of different kinds and for different vessels are formed of strips of cloth or canvass sewed together, after they are cut to proper shapes and lengths, and as it is customary to cut said strips from what is usually termed a roll or bolt of canvass, it becomes desirable to accomplish the same, with as little waste of

material as possible, or in other words, so to measure the lengths and gore of each strip, that when the whole are sewed together, the sail thus formed shall possess the desired shape, and in nautical language, set well when adjusted and exposed to the action of the wind.

"In order that the use and adaptation of my improvements may be more particularly understood, I shall proceed to state the mode usually practised of cutting the cloths of a sail from a long or extended piece of canvass.

"We will suppose, for the purpose of explanation, that we wish to cut up a roll of canvass for the purpose of converting the same into a sail usually termed a jib. To cut the first cloth, presuming the canvass is square on the end, it is necessary to set up from the end a certain determined distance (called the gore on the foot—and which we will suppose six and one half inches,) on either selvage of the canvass, and there make a suitable mark. Then cut from the said mark diagonally across the canvass to the extreme point of the opposite selvage, and thus we shall have formed the foot gore for the first cloth.

"Next measure up on the selvage from the foot or mark above mentioned, the length of the after leech, (which suppose forty-two feet,) then from the extremity of the distance so measured, set downwards another certain determined distance called the gore on the stay, and which we will suppose to equal four feet and four inches. Next following the filling thread, so marked across the strip of canvass, to the opposite selvage, and make a suitable mark thereon, which mark will be in a line perpendicular to the selvage. Next cut the cloth from the last mentioned mark diagonally to the mark denoting the length of the first cloth, and thus we form the stay gore for the first and second cloths. Turn the canvass so as to bring the longer selvage even in a line with the shorter selvage of the first cloth. Measure down by this cloth for the length of the second cloth, and mark it; thence take a thread as before to the opposite selvage; thence set off six and one half inches (the foot gores) downwards; mark it and cut diagonally as before to the mark denoting the length of the second cloth on the opposite selvage, and thus we obtain the foot gore or slope of the second and third cloths. Turn the canvass on the foot, as before, on the head, and continue measuring, turning, and cutting until all the cloths are so prepared."

Claim—"I claim the scales in combination with the other scales, ruler, and circle, the whole constructed, arranged, graduated, and operating together substantially in the manner above mentioned and described, and for the purpose of determining the angle of the gores on the head, foot, and leeches of different sails, as herein above explained.

"I also claim the combination with the above specified parts of the ruled table or card, constructed and arranged substantially as above described, for the purpose of determining the number of breadths or cloths of canvass in a sail, in the manner hereinbefore explained.

"Furthermore, I claim the curved ruler, constructed and arranged

substantially as described, in combination with the rules, table or card, and the scales for the purpose of determining the angles of the gores of the roach or sweep of the foot of a sail, in the manner herein before explained."

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24. For an *Improvement in Saw Mills;* Chas. D. Wright, Colchester, New London county, Connecticut, September 30.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have formed, combined, and arranged the arm, the kneed lever, the rack and the regulating bolt, and their appendages, so that by the action of the inclined plane on the said arm, the respective parts shall co-operate in setting the log; the whole being constructed and actuated in the manner, or substantially in the manner herein set forth."

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25. For an *Improvement in the Cultivator;* Marshall J. Hunt, Cincinnati, Hamilton county, Ohio, September 30.

The patentee says,—"In my corn and cotton plough and cultivator, I use three cultivator teeth, which are affixed permanently to the frame by wedges, or screw nuts, and two teeth, or mould boards, which are attached to two sliding bars passing through a mortise at the rear end of the frame; which bars are retained in place by wedges, or otherwise, so as to admit of the placing of the teeth, or of the mould boards, which are attached to them, at such a distance apart, as shall adapt them to the rows of cotton, corn, or other articles under cultivation; and which admits, also, of the shifting of the mould board so as to turn the earth outwards or inwards, against the plant. I also make the drawing bar, or tongue, to which the horse is attached, to rise or fall in such manner as to determine the depth to which the cul tivator teeth shall enter the ground."

Claim.—"Having thus fully described the nature of my improve ments in the corn and cotton plough and cultivator, and shown the manner in which the same operates, what I claim as new and desire to secure by letters patent, is the employment of two sliding bars, carrying two cultivator teeth, or two mould boards, which may be shifted and set, in the manner and for the purpose set forth."

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26. For an *Improvement in Printing Presses*; Joel G. Northup, Cortlandtville, Cortlandt county, New York, September 30.

The patentee says,—"The principal improvement in my Press, consists in the manner in which I bring two or more forms of type, alternately under the platen, or under the cylinder of a printing press, and also under the inking apparatus, for the purpose of inking the forms. The apparatus by which I effect this, may be applied either to a cylinder or to a platen press."

Claim.—"What I claim as new and desire to secure by letters pat-

ent, is first, the combining with a printing press, two or more forms of type, placed on suitable beds; and the carrying them around so as to bring them alternately under the platen of a platen press, or under the cylinder of a cylinder press; the requisite motion being given to them substantially as set forth, and under such modifications as will be rendered necessary by the kind of press to which the improvement is applied. Secondly, I claim in the platen press, the manner in which I have combined and arranged the system of levers, the tympan frame, and tympan, the bed and the stud for moving, reversing, and sliding off the tympan; the respective parts being arranged and operating substantially as made known."

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27. For an *Improvement in Boring, Tapping, and Reaming Water, or other pipes, under Hydrostatic Pressure;* H. A. Norris, City of New York, September 30.

Claim.—"I claim as my invention, and desire to secure by letters patent, the connexion of the ferulet and drill shaft with each other by means of a sliding or swinging frame, upon which both of them work, according to the principles herein set forth, and by which, either is removed, and the other instantly brought into its place, thus avoiding the necessity of a valve to prevent the flow of water in the interim. I also claim the ferulet shaft, (or any analogous device substantially as herein described for holding the ferulet for insertion,) working in a sliding or swinging frame as herein described, in combination with the drill, whether working in the same frame or not. And I further claim the drill working in a sliding or swinging frame as herein described, in combination with the ferulet shaft, whether working in the same frame or not."

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28. For an *Improvement in Regulating the Height of Water in Steam Boilers;* Cadwallader Evans, Pittsburg, Allegheny county, Pennsylvania, September 30.

Claim.—"What I claim as new, and desire to secure by letters patent, is the application of a float within a separate cylinder or vessel connected above and below the water line of a steam boiler. The advantage of this arrangement is that there will be no ebullition or foaming in the separate vessel as to agitate the float."

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29. For an *Improvement in Hemp and Flax Machines;* William McMillen, Ripley, Brown county, Ohio, September 30.

The patentee says,—"The nature of my invention consists in breaking and cleaning hemp in one machine, without handling it, after it enters the machine till it is cleaned, the hemp entering a hopper on the top, and passing down through brakes placed underneath, and after being cleaned, coming out at the bottom ready for market."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the machine with two breaks and two

pairs of feed rollers, so that the hemp passing down vertically shall be fed from one brake to the other without handling, and in combination therewith the "scutcher," combined and arranged as above described.

"I also claim the spring bars in combination with the stationary swords in the manner and for the purpose herein set forth.

"I also claim the rods, attached to the stationary swords for preventing the hemp from following the movable blades, constructed and combined for the purpose above specified."

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30. For an *Improvement in Steering Vessels;* George W. and Ezra B. Robinson, Boston, Massachusetts, September 30.

The patentees say,—" The design and purpose of our said invention is to turn the rudders of vessels by a new and more advantageous application of mechanical powers, and without the use of a tiller or tiller ropes.

"For the purpose of using our said invention, the rudder head should rise above the deck, nearly as high as the axis of a vertical steering wheel of a convenient diameter and position, which will probably be from twelve to fifteen inches higher than the rudder head is usually made. On the top of this rudder head, which may be made polygonal for the purpose, is fixed a strong metallic horizontal cog wheel of about twenty inches in diameter; playing into the teeth of this wheel, on each side of it, is a horizontal metal rack moving fore and aft in parallel guides; these racks are to be of such a length and with such a number of teeth as to turn the cog wheel as far each way as the rudder ever needs to turn. This will require the whole length of the racks to be about two feet seven inches, and the teethed part eighteen inches. The guides are in the sides of an oblong frame, long enough to permit the play of the racks and a little higher than the top of the rudder head. The forward end of one of the racks, and the after end of the other, is prolonged solid and without teeth, and bent upwards and turned inwards to the middle of the frame, so as to rise so far above the line of the top of the rudder head, that the bottom of the shaft hereafter described shall be two inches above the rudder head so as to allow the rudder the necessary play up and down. These prolongations of the racks end in hollow nuts above five inches long, with spiral threads cut in contrary directions, that is, with right hand threads in one nut, and left hand threads in the other. These two nuts are in a line with each other, which line passes over the centre of the rudder head, and having bearings on the two ends of the frame, is a horizontal iron shaft about six feet long and two and three quarter inches in diameter; the forward end of which is fixed to the centre of the steering wheel as its axis. Where this shaft passes through the nuts it is formed into two spiral screws, each about twenty inches long, having two or three threads of such obliquity as to give about two-and-a-half inches at each turn of the wheel, to enable the rudder to give sufficiently to the force of the seas. One of the screws is a right hand screw, and the other a left hand screw corresponding to the nuts above described. On the after end of the shaft, and out-

side of the frame, is placed a vertical steering wheel of the usual size and form. As the steering wheel is turned, the spiral screws on the shaft move one rack forward and the other back, turning the cog wheel and the rudder to the right or left as required. Instead of having the frame supported at the after end, it may be bolted into the stern frame of the vessel, and properly braced, by which it may be made to occupy less room on the deck."

Claim.—"What we claim, and desire to secure by letters patent, is the machine or combination, consisting of the cog wheel on the rudder head, the sliding racks, with the hollow nuts and screws, the shaft, with the right and left hand screws, and the steering wheel; the whole combined as before described, and for the purpose aforesaid."

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines. By M. V. Regnault.

(Continued from page 55.)

FIFTH MEMOIR.

On the Absolute Dilatation of Mercury.

As the dilatation of mercury is one of the most important data in Physical experiments, it has been, as might be expected, determined by a great number of experimenters. As, however, they have had in view for the most part, only the correction of the height of the barometrical column due to changes of temperature, their experiments have but seldom been carried much above atmospheric temperatures, and the value of this important quantity accepted by philosophers is that determined by Dulong and Petit, for temperatures from 0° to 300°. (32° to 572° Fahr.) *(Annales de Chimie et de Physique, tome VII, p. 124.)*

It is to be regreted that these skilful experimenters did not publish their actual results, but only a few means, which, even supposing them perfectly exact, are insufficient for the wants of science, as they do not permit us to trace the curve of the dilatations which it is necessary for us to know with great precision.

But these numbers are necessarily inexact, since they were calculated with a coefficient for the dilatation of air, much too great; for this error, however, the proper allowance may now be made, and M.

Regnault gives a corrected table of their results which is as follows:

Temperature by air thermometer.		Mean absolute dilatations of mercury.	
Fahr.	Cent.		
32°	0°		
212°	100°	$\frac{1}{5677}$	0·00017615
392°	200°	$\frac{1}{5550}$	0·00018018
572°	300°	$\frac{1}{5423}$	0·00018440

The method used by Dulong and Petit for their experiments consisted in placing the mercury in two tubes 0·55 metre in height, connected below by a tube of very small diameter; one of the vertical tubes was surrounded by ice, and the other immersed in a boiler filled with oil, which could be heated to the desired temperature. The advantage of this method is that it is totally independent of any hypothesis, and of any correction for the dilatation of the tubes, reposing simply upon the hydrostatic law, that if two columns of liquids of different densities communicate with each other at their base, their heights above the plane of contact are inversely as their densities. The simple observation of the difference in the height of the columns, therefore, gives the means of determining the change of density in the heated column, and since the densities are inversely as the bulks, this will give the increment of bulk: that is, the dilatation, for the known temperature.

M. Regnault, however, makes the following practical objections to these experiments:—

1st. As it was necessary to observe directly the tops of the mercurial columns, that in the heated oil was required to rise a short distance above the surface of the bath, and the temperature of this part of the column was uncertain.

2nd. The oil bath could not be stirred up during the experiment; the temperature of the oil therefore differed at different heights above the furnace.

3rd. The capillary action in the two tubes was not the same, because the temperatures of the columns were very different.

4th. The difference of the heights of the two columns was very small, and required to be measured with extreme nicety; and he shows, from their own record of the maximum and minimum values of these differences, that their instruments were not sufficiently delicate to give the precision which the experiments, from their close accordance with each other, appear to have.

Lavoisier and Laplace, in their determination of the dilatation of mercury, used another method. They observed the apparent dilatation of mercury enclosed in a glass reservoir, and determined the

linear dilatation of the reservoir by observation of a rod of the same kind of glass.

By a proper modification of this method it would be possible to determine directly,—1st, the temperatures, deduced from the dilatation of the air;—2nd, the linear dilatation of the glass tube;—3rd, the apparent dilatation of mercury in the same tube. To calculate from this the absolute dilatation of mercury it must be assumed:

1st. That the cubic dilatation (δ) and the linear (λ) are connected by the formula $$\delta = 3\lambda + 3\lambda + \lambda^3,$$ which will be true only when the material dilates equally in all directions, which depends upon its molecular condition.

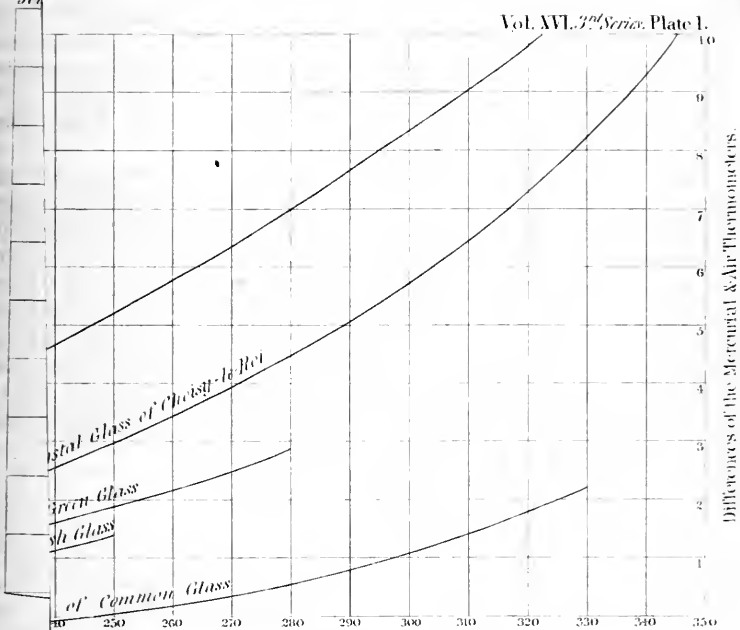
2nd. That the dilatation of the envelope is exactly that which it would be, if it made part of a solid and continuous body of the same substance; a hypothesis again based upon mathematical considerations, but never yet subjected to the test of experiment.

By their mode, Lavoisier and Laplace determined the dilatation of mercury between 0° and 100° to be 0·01811.

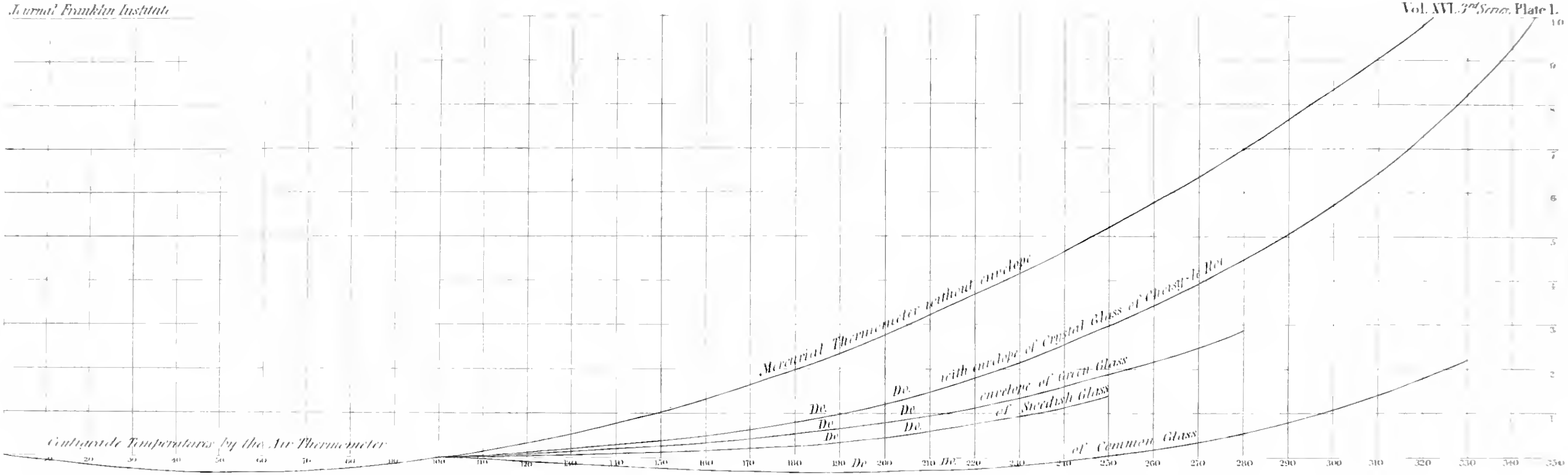
The apparatus used by M. Regnault is founded upon the first method, that of observing the difference of heights of two communicating columns, but is so arranged as to avoid the practical objections which he has pointed out in the apparatus of Dulong and Petit.

The description of the apparatus and the method of experimenting, however, would occupy so much space that we omit them with the simple remark, that no pains seem to have been spared to insure minute accuracy.

The following table includes the values calculated from his experiments by means of graphic projection, and a parabolic formula of interpolation :—



corrected for the Dilatation of its Envelope.



Differences between the Temperatures shown by Mercurial Thermometers, and those given by an Air Thermometer corrected for the Dilatation of its Envelope

Table of the True Dilatations of Mercury.

Temperature by air thermom'r. Fah.	Cent. T	Dilatation of mercury from 0° to T.° δ_T	Mean coefficient of dilatation from 0° to T.° δ	Real coefficient of dilatation at T. $\frac{d.\delta_T}{d.T}$.	Temperature deduced from absolute dilatation of mercury. θ	Difference betw'n a thermometer founded upon the absolute dilatat'n of mercury, and the air thermometer. $(\theta - T)$
°	°				°	°
32	0	0·000000	0·00000000	0·00017905	0	0
50	10	0·001792	0·00017925	0·00017950	9·872	— 0·128
68	20	0·003590	0·00017951	0·00018001	19·776	— 0·224
86	30	0·005393	0·00017976	0·00018051	29·709	— 0·291
104	40	0·007201	0·00018002	0·00018102	39·668	— 0·332
122	50	0·009013	0·00018027	0·00018152	49·650	— 0·350
140	60	0·010831	0·00018052	0·00018203	59·665	— 0·335
158	70	0·012655	0·00018078	0·00018253	69·713	— 0·287
176	80	0·014482	0·00018102	0·00018304	79·777	— 0·223
194	90	0·016315	0·00018128	0·00018354	89·875	— 0·125
212	100	0·018153	0·00018153	0·00018305	100 "	0·000
230	110	0·019996	0·00018178	0·00018455	110·153	+ 0·153
248	120	0·021844	0·00018203	0·00018505	120·333	+ 0·333
266	130	0·023697	0·00018228	0·00018556	130·540	+ 0·540
284	140	0·025555	0·00018254	0·00018606	140·776	+ 0·776
302	150	0·027419	0·00018279	0·00018657	151·044	+ 1·044
320	160	0·029287	0·00018304	0·00018707	161·334	+ 1·334
338	170	0·031160	0·00018329	0·00018758	171·652	+ 1·652
356	180	0·033039	0·00018355	0·00018808	182·003	+ 2·003
374	190	0·034922	0·00018380	0·00018859	192·376	+ 2·376
392	200	0·036811	0·00018405	0·00018909	202·782	+ 2·782
410	210	0·038704	0·00018430	0·00018959	213·210	+ 3·210
428	220	0·040603	0·00018456	0·00019010	223·671	+ 3·671
446	230	0·042506	0·00018481	0·00019061	234·154	+ 4·154
464	240	0·044415	0·00018506	0·00019111	244·670	+ 4·670
482	250	0·046329	0·00018531	0·00019161	255·214	+ 5·214
500	260	0·048247	0·00018557	0·00019212	265·780	+ 5·780
518	270	0·050171	0·00018582	0·00019262	276·379	+ 6·379
536	280	0·052100	0·00018607	0·00019313	287·005	+ 7·005
554	290	0·054034	0·00018632	0·00019363	297·659	+ 7·659
572	300	0·055973	0·00018658	0·00019413	308·340	+ 8·340
590	310	0·057917	0·00018683	0·00019464	319·048	+ 9·048
608	320	0·059866	0·00018708	0·00019515	329·786	+ 9·786
626	330	0·061820	0·00018733	0·00019565	340·550	+ 10·550
644	340	0·063778	0·00018758	0·00019616	351·336	+ 11·336
662	350	0·065743	0·00018784	0·00019666	362·160	+ 12·160

SIXTH MEMOIR.

On the Law of the Compressibility of Elastic Fluids.

When a gas enclosed within a space with movable walls, is exposed to a constantly increasing pressure, it is reduced to a smaller and smaller bulk. Boyle *(Defensio contra Linum)* and Mariotte *(Œuvres de Mariotte, La Haye,* 1740; *tome* I. *De la Nature de l'air, page* 152*)* were the first philosophers who endeavored to determine the law of this contraction.

The experiments made upon atmospheric air led them to establish a very simple law, known frequently as the *law of Boyle,* but more generally as the *law of Mariotte. The volumes which the same mass of air occupies at a constant temperature, are inversely proportional to the pressures which the gas sustains. Or in other words: The densities of air at the same temperatures, are proportional to the pressures.* Since their time, a great number of philosophers have sought to satisfy themselves by experiment whether this law ought to be admitted rigorously for atmospheric air under the heaviest pressures, and whether it was applicable to other elastic fluids.

Boyle had already thought that he had remarked that for pressures above four atmospheres the air was less compressed than it ought to be according to this law. Muschenbrock *(Cours de Physique, Paris,* 1759, *tome* III, *p.* 142,*)* came to a similar conclusion.

Sulzer, *(Memoires de Berlin, Année* 1753, *p.* 116,*)* in experiments carried up to eight atmospheres, found, contrary to the conclusions of Boyle and Muschenbrock, that starting even from a single atmosphere, the air was compressed much more than the law of Mariotte indicated.

Robinson, *(System of Mechanical Philosophy, Vol.* III, *p.* 637,*)* thinking that the differences observed by Sulzer arose from the fact of the air not having been completely dried, made new experiments upon air dried by quick lime, moist air, and air charged with the vapor of camphor, but he found the differences greater than those which presented themselves in the experiments of Sulzer.

MM. Œrstedt and Swendsen *(Edinburgh Journal of Science, Vol.* IV, *p.* 224*)* published in 1826 a series of experiments performed with a more perfect apparatus than that of their predecessors, and they concluded that, up to eight atmospheres, the air followed almost exactly the law of Mariotte. It is to be remarked that all the differences between their experimental results and those of the theory are positive, which would go to prove that the air is really compressed a little more than it ought to be according to the law; but as the differences do not increase regularly with the pressures, they are rather to be attributed to errors of observation.

In the foregoing experiments the elastic force of the gas was measured by the weight of the column of mercury which equilibriated it, but they could not be carried beyond eight atmospheres. MM. Œrstedt and Swendsen sought by another method to verify the law of Mariotte under heavier pressures. For this purpose they compressed the air in the reservoir of an air-gun. They determined the weight

of air introduced, and consequently its density, by means of a balance. The elastic force of the gas was measured by the pressure exerted upon a steel valve fitted upon the reservoir, and kept closed by means of a movable weight sliding upon a counter-balanced lever. The weight was gradually slid along the lever until the elastic force of the air raised the valve. This method employed to determine the pressures, cannot give precise measures, and the results can only be considered as approximations. Nevertheless we may conclude from these experiments, that, up to a pressure of sixty-eight atmospheres, the atmospheric air does not depart considerably from the law of Mariotte.

The same experimenters examined whether the law of Mariotte applied to other gases. For this purpose they compared, under similar circumstances, the compressibility of a gas easily liquefied, such as sulphurous acid, with the atmospheric air. They found that up to two or three atmospheres the two gases followed sensibly the same law, but that from that point upwards the compressibility of the sulphurous acid became greater, and increased with the pressure; so that when the condensation of the atmospheric air was 3·189, that of the acid was 3·319. The liquefaction of the sulphurous acid took place at a pressure a little above this, at the temperature at which they operated.

M. Despretz confirmed this latter result by new experiments, and found by a similar process that the gases sulphurous and hydrosulphuric acids, cyanogen and ammonia, compared with atmospheric air, departed from the law of Mariotte and presented compressibilities increasing with the pressures, even from two atmospheres; that hydrogen and atmospheric air moved sensibly together up to 15 atmospheres, but he adds that, at the pressure of 20 atmospheres, the air leads notably.

Finally, the last uncertainties existing as to the law of Mariotte, applied to atmospheric air, seemed to disappear after the beautiful experiments which MM. Arago and Dulong (*Memoires de l'Academie des Sciences, tome* x. *Annales de Chimie et de Physique, tome* XLIII, *2de Serie, p.* 74) undertook at the request of the Academy, the object of which was to determine the relation existing between the elastic forces and temperatures of saturated steam.

These illustrious philosophers determined the law of contraction of the atmospheric air up to 27 atmospheres; the volumes of the gas were measured in a tube graduated into equal capacities, and 1·7 metre in length, and the elastic forces were measured by the heights of the columns of mercury which counterbalanced them.

In 39 determinations which they made upon the same mass of air submitted to pressures varying from 1 to 27 atmospheres, the differences between calculation and observation never amounted to $\frac{1}{100}$, and these differences did not increase with the pressure, as they should have done if they were owing to a real deviation from the law of Mariotte.

The principal object of MM. Dulong and Arago in these experiments was not, however, to verify the law of Mariotte, but to construct

a compressed air manometer *(pressure-gauge)* graduated directly by means of the column of mercury, which might serve to measure the tensions of steam at high temperatures. On this account, their apparatus was not arranged in the most favorable way to determine slight divergences which might occur from the law of Mariotte. With this apparatus, as with all others which have been heretofore employed for the same purpose, the principal difficulty consists in the precise measurement of the volume of the air.

Lately, M. Pouillet has undertaken the determination of the law of condensation of some other elastic fluids. All that is known of his labors is by an extract which he has published in the fourth edition of his *Elements de Physique, tome* I, *p.* 327. His method of experimenting was similar to that followed by MM. Œrstedt and Despretz, the tubes in which the gases under comparison were enclosed were two metres long.

M. Pouillet deduced from his researches the following conclusions:

1st. Up to 100 atmospheres, oxygen, nitrogen, hydrogen, nitric oxide, and carbonic oxide, follow the same law of compression as the atmospheric air.

2d. The gases sulphurous acid, ammonia, carbonic acid, and nitrous oxide, begin to be notably more compressible than the atmospheric air, as soon as their volume is reduced to $\frac{1}{3}$ or $\frac{1}{4}$.

3d. Hydrogen, the protocarburet and bicarburet of hydrogen, (olefiant and light carburetted hydrogen gases,) although not liquefied at a temperature of 8° or 10°, under a pressure of 100 atmospheres, have nevertheless a compressibility sensibly greater than that of the air.

Yet, notwithstanding that the most accurate experiments heretofore made seemed to establish incontestably the fact, that up to a pressure of 30 atmospheres the atmospheric air followed rigorously the law of Mariotte, this conclusion seemed to M. Regnault difficult to reconcile with the very notable variations which he had detected in the coefficient of dilatation of atmospheric air, according as it was submitted to greater or less pressures. (See the First Memoir: on the Dilatation of Gases, Journ. Frank. Inst., Vol. xv., p. 282.) The determinations which he had made of the densities of air under pressures less than one atmosphere, (Second Memoir: on the Density of Gases, Vol. xv., p. 361,) augmented his uncertainty upon this point.

The law of the contraction of gases under different pressures, and at a constant temperature, is a fundamental law of physics; it enters into all the determinations which are made with gases, and consequently influences almost all the phenomena of heat; it is therefore of the greatest importance that no uncertainty should remain as to this law. M. Regnault did not therefore hesitate to undertake a new examination of this subject, notwithstanding the imposing authority of the philosophers who had already given their attention to it.

In all the methods which had hitherto been used for the purpose of investigating this law, the principal difficulty consisted in the precise measurement of the volume of the air. The primitive volume of the air being one under the initial pressure of one atmosphere, is but $\frac{1}{5}$,

under a pressure of 5 atmospheres, $\frac{1}{10}$ under a pressure of 10, and $\frac{1}{20}$ under a pressure of 20 atmospheres.

Thus, under heavy pressures the volume is very small, and it becomes impossible to measure it with great exactness, especially if we pay attention to the extreme difficulty which is met with in the exact determination of the diameter of a glass tube, and the uncertainties which result from the variations in form of the meniscus of mercury in various tubes.

But it is easy to avoid all these difficulties, and consequently to obtain great exactness by arranging the experiments according to the following principle.

A glass tube of an interior diameter of from 8 to 10 millimetres, (0·3 or 0·4 inches,) and of 3 metres (9·846 feet) in length, is placed in a vertical position. This tube, closed at its upper extremity by a stop-cock, communicates below with a second very long vertical tube, intended to contain the column of mercury which is to press upon the air inclosed in the first tube. Upon this first tube two marks are placed: one near its lower end corresponds to one volume, the second corresponds exactly to half the capacity of the tube, from its upper end to the first mark, and consequently indicates a half volume.

The tube is filled to the first mark with dry air under a pressure of one atmosphere; this air is then compressed by increasing the height of the column of mercury so as to confine it in the part of the tube above the second mark, its volume is then one-half. If the law of Mariotte is rigorously exact, the elastic force of the gas should then be equal to two atmospheres.

The tube is then filled as before with dry air under a pressure of two atmospheres, and this is, by increasing the column of mercury, compressed into half its bulk; the pressure should then be four atmospheres. The tube is then filled with air under a pressure of four atmospheres, and when compressed into half its bulk, the pressure should be eight atmospheres, and so on.

By this mode of operating, the volume of gas is always large and consequently susceptible of accurate measurement, and as the meniscus is always brought to the same mark, all uncertainty of graduation is avoided.

By placing a third mark, corresponding to one-quarter the volume, it can be determined whether a gas acquires four times the elastic force when compressed into one-fourth its bulk.

In the apparatus of M. Regnault, the long tube for the measurement of the pressures was 24 metres (78·77 feet) long, made of tubes of flint glass, each 3 metres (9·846 feet) long, and connected together by iron tubulures, which by an ingenious clasp could be rendered perfectly tight, yet had no tendency when tightened to twist the tubes, and could be easily and rapidly undone. The tubes were carefully adjusted in the vertical by a plumb line, and it was found that they were quite strong enough to bear the enormous column of mercury, which sometimes filled them. These tubes were made expressly for this purpose at the manufactory of Choisy-le-Roi, and were each three metres in

length, ten millimetres (0·394 in.) in interior diameter, and five millimetres (0·197 in.) thick. M. Regnault determined by careful observations upon marks placed on the tubes, that the enormous pressure brought upon them did not sensibly alter their form or capacity. Marks were placed near the top of each tube, and the distances between these, as well as the distance after connexion between the top mark of one tube and the bottom one of the one immediately above it, were carefully measured. Movable platforms, which permitted the observer to elevate or lower himself at pleasure, allowed the distance of the top of the mercurial column from the nearest mark on the tube to be measured at all times with great accuracy. Four of these tubes, or about 12 metres, were within the tower in which the apparatus was established, the remaining 12 metres of tube were supported upon an elevated and properly braced frame work. Thermometers placed along side of the tube, every $1\frac{1}{2}$ metre (5 feet) gave the actual temperatures, the mean of which was taken as the temperature of the column.

The following corrections were calculated and applied to the immediate data of observation:—

1st. On account of the differences of the atmospheric pressure upon the summit of the manometric column, and upon the cistern of the barometer which was below. The correction for this, for a difference of 25 metres, was 2·375 mm.

2d. On account of the compressibility of the mercury, the correction for 25 metres was 1·356 mm.

3d. For the augmentation of internal capacity of the tube which contained the air, under the heavy pressures. This, it was shown, might be altogether neglected, as it did not amount to $\frac{1}{16,666}$ under a pressure of 25 atmospheres.

4th. For the changes of temperature of the air while under measurement. This never amounted to more than a few hundredths of a degree, (the tube was kept cool by a constant stream of water,) and this change was indicated by a very sensitive thermometer, and reduced to invariability by calculation.

The deductions which M. Regnault draws from his experiments (the tabulated results of which will be found at the end of this abstract) are as follows:—

1st. The atmospheric air does not rigorously follow the law of Mariotte, but is in reality compressed a little more than it ought to be according to that law, and these differences increase regularly with the pressures.

2d. Nitrogen gas presents the same anomaly as the atmospheric air.

3d. In the case of carbonic acid, the differences are so considerable, that under heavy pressures the law of Mariotte cannot even be considered as approximately true.

4th. Hydrogen gas does not follow the law of Mariotte better than the air; but what is remarkable, departs from it in the opposite direction. Whilst the air and the other gases hitherto studied are compress-

ed more than they ought to be according to the law of Mariotte, hydrogen gas shows a *less* compressibility than the law gives, and this compressibility diminishes as the pressure increases. The elastic force of hydrogen is therefore similar to that of a metallic spring, which offers a greater resistance to compression, in proportion as the pressure to which it is already subjected is greater.

This last result appears to be of very great importance for the mechanical theory of gases. We are accustomed to look upon the law of Mariotte as the mechanical expression for a *perfect gas.* When a gas does not follow this law rigorously, and its compressibility is greater than it ought to be, we consider the gas as *imperfectly elastic*; a condition which has already been recognized for a great number of gases. These experiments show that it is true even for atmospheric air and nitrogen. For all these gases the law of Mariotte may be considered as a *limiting law,* which is not rigorously observed except when the gases are infinitely dilated, and from which they depart more and more, in proportion as they are in a more condensed state.

These considerations are greatly modified by the experiments on hydrogen gas. If the law of Mariotte were the mathematical expression of a perfectly gaseous state, hydrogen would be a *more than perfect elastic fluid,* following the law of Mariotte *at the limit,* that is, when it is extremely dilated, but opposing an elastic resistance which becomes greater with its state of condensation. It is nevertheless probable that this elastic resistance does not augment indefinitely with the condensation; in other words, it is probable that the ratio (obtained by dividing the ratio of the volumes by the inverse ratio of the pressures) $\dfrac{\left(\frac{V_0}{V_1}\right)}{\left(\frac{P_1}{P_0}\right)}$ (which we shall hereafter for simplicity write ρ) attains a certain minimum which is perhaps placed far beyond the limits of our experiments, that it afterwards increases and approaches unity, which it attains at a certain state of condensation, in the vicinity of which it follows the law of Mariotte strictly. The condensation augmenting, hydrogen departs again from the law of Mariotte, in the opposite direction; the ratio ρ becomes greater than unity, and goes on increasing until the gas is liquefied.

The temperature certainly exercises a great influence upon this phenomenon. It has been shown (in the memoir upon the density of gases, Vol. XV, p. 361) that carbonic acid gas departs notably from the law of Mariotte under pressures less than one atmosphere, when it is kept at a temperature 0°, but that it no longer departs from it to a sensible degree for very light pressures, when kept at a temperature of 100°.

In studying the compressibility of atmospheric air at high temperatures, it will be found that it departs much less from the law than it does at ordinary temperatures within the same limits of density; and it is likely that a temperature might be obtained at which the divergencies would not be observable. It is even very probable that

at a still higher temperature, the atmospheric air would depart again from Mariotte's law, but in the opposite direction: that is, in the direction in which hydrogen departs at ordinary temperatures.

Similar circumstances, but in an inverse order, will present themselves for hydrogen, when submitted to temperatures lower and lower.

M. Regnault thinks that there exists for every gas, taken at a certain state of condensation, a temperature at which it follows sensibly the law of Mariotte for limited variations of pressure; that is at which $\rho - 1 = 0$. (It will be remembered that we write ρ for $\frac{\left(\frac{v_0}{v_1}\right)}{\left(\frac{p_1}{p_0}\right)}$.)

Below this temperature the gas, in the same state of condensation will present a greater compressibility than that belonging to the law; that is, we shall have $\rho - 1 > 0$; this is the condition in which we find the air, nitrogen, carbonic acid, &c., at ordinary temperatures.

On the contrary, above this temperature, the gas in the same state of condensation will present a less compressibility than that deduced from the law; that is, $\rho - 1 < 0$, and the gas will be found in the condition seen in the case of hydrogen gas at ordinary temperatures.

The temperature at which the function $\rho - 1$ changes its sign, varies necessarily for every gas, with its density; it is higher as the density is greater.

It will be seen, from what has been said, that it would be of the greatest importance to study the compressibility of the gases at high temperatures; unfortunately this study presents almost insurmountable difficulties from the impossibility of obtaining stationary high temperatures.

M. Regnault then proceeds to give a sketch of two methods for such determinations, which as they have not been applied in practice, we omit.

(To be Continued.)

On the Construction and Power of a new form of Galvanic Battery. By the Rev. NICHOLAS CALLAN, *D. D., Professor of Natural Philosophy in Maynooth College.*

In a paper published in the August number of the London Philosophical Magazine, I described several experiments, which clearly prove that, as a negative element of the nitric acid battery, lead coated with chloride of gold or platina, or with borax dissolved in dilute acid, is superior to platina, and that cast iron is fully as powerful as platina. I have since compared, in various ways, the power of a cast iron battery with that of a Grove's of equal size. The cast iron was excited by a mixture consisting of about four parts of sulphuric acid, two of nitric acid, and two of nitre dissolved in water. The platina was excited by equal parts of concentrated nitric and sulphuric acid. The

zinc plates of both batteries were excited by dilute sulphuric acid of the same strength. The cast iron battery was considerably superior to Grove's, in its magnetic power, in its heating power, and in its power of producing decomposition. The magnetic effects of the two batteries were compared by means of a galvanometer and of a small magnetic machine. Grove's produced a deflection of 82°; the cast iron caused a deflection of 85°. When the voltaic currents of the two batteries were sent simultaneously, in opposite directions, through the helix of the galvanometer, the current from the cast iron battery destroyed the deflection caused by Grove's, and produced an opposite deflection of 60°. In the magnetic machine, the cast iron battery produced fifty revolutions in a minute; Grove's produced only thirty-five in the same time.

The superiority of the heating power of the cast iron battery was shown by its fusing a steel wire, which Grove's only raised to a dull red heat. I have been told by persons who tried the two batteries, that they found the heating power of the cast iron battery to be twice as great as that of Grove's.

The decomposing powers of the two batteries were compared by the quantities of the mixed gases which they produced during the space of three minutes. The result clearly established the superiority of the cast iron battery.

I have tried various kinds of cast iron, and have found them all to possess nearly equal power. I have got cast iron plates containing oxide of chromium: they did not appear to have any advantage over common cast iron. Perhaps, by mixing with cast iron some of the more negative elements, an increase of power may be obtained.

Soon after I had discovered the great electromotive power of platinized lead and cast iron, when excited by nitric or nitro-sulphuric acid, I proposed to the trustees of the College to change our Wollaston batteries into a platinized lead or cast iron one. They readily authorized me to expend the sum required for the change. After weighing well the relative advantages of platinized lead and cast iron, I resolved on the latter, principally because I found that it did not require to be platinized.

In this battery, which was exhibited in the College on the 7th of the last month, there were 300 cast iron water-tight cells, each containing a porous cell and zinc plate 4 inches square; 110 cast iron cells, each holding a porous cell and zinc plate 6 inches by 4; and 177 cast iron cells, each containing a porous cell and a zinc plate 6 inches square. The zinc plate of each circle was placed in a porous cell, and the latter in a cast iron cell. The inside of each cast iron cell was about a quarter of an inch wider than the exterior of its porous cell. Slips of sheet copper, about an inch broad, and 2½ inches long, were soldered to each cast iron cell, and to each of the 320 six-inch zinc plates. The 4-inch plates were already furnished with screws and nuts. Each iron cell was connected by a binding-screw with the next zinc plate. The iron cells were kept in an upright position in nine wooden frames, which were placed on wooden supports nearly three feet high. The battery was charged by pouring into each cast iron cell a mixture containing

about twelve parts, by measure, of concentrated nitric acid, and eleven and a half parts of double rectified sulphuric acid; and, by filling to the proper height, each porous cell with dilute nitro-sulphuric acid, consisting of about five parts of sulphuric acid, two of nitric, and forty-five of water. In charging the entire battery, we used about fourteen gallons of nitric, and sixteen of sulphuric acid. I abstained from using the solution of nitre, through an apprehension that it would cause the exciting mixture in the cast iron cells to boil over. I know not whether this apprehension is well founded; but I know that when ten or more cells are employed, the exciting fluid in the cast iron cells will soon boil over, and produce nitrous fumes, if it does not contain one-quarter of its bulk of nitric acid.

I have found by experiment, that a cast iron battery is about fifteen times as powerful as a Wollaston battery of the same size, and nearly as powerful and a half as Grove's. Hence our new cast iron battery, in which there are 96 square feet of zinc, is equal in power to a Wollaston battery containing more than 1400 square feet of zinc, or more than 18,000 four-inch plates, and to a Grove's containing 140 square feet of platina. Now the battery made by order of Napoleon, for the Polytechnic School, which was the largest zinc and copper battery ever constructed, contained only about 600 square feet of zinc; and the most powerful Grove's of which I have seen an account, did not contain 20 square feet of platina. Hence the cast iron battery belonging to the College, is more than twice as powerful as the largest Wollaston, and seven times as powerful as the largest Grove's ever constructed.

I shall now describe a few of the experiments which were made with our large cast iron battery on the 7th of the last month. The first experiment consisted in passing the voltaic current through a very large turkey, which was instantly killed by the shock. The craw of the turkey was burst, and the hay and oats contained within it fell to the ground. In order to give the shock, a piece of tin-foil, about four inches square, was placed under each wing along the sides of the turkey, which were previously stripped of their feathers, and moistened with dilute acid. The tin-foil was kept in close contact with the skin, by pressing the wings against the sides. The person who held the turkey had a very thick cloth between each hand and the wing, in order to save him from the shock. As soon as the wire from the zinc end of the battery was put in contact with the tin-foil under one wing, sparks were given by the tin-foil, and shocks received by the turkey, before the connexion was made between the negative end of the battery and the tin-foil under the other wing, although the negative and positive ends of the battery were on tables nearly 3 feet high and 3 feet asunder.

When a copper wire, in connexion with the negative end, was put in contact with a brass ring connected with the zinc end of the battery, a brilliant light was instantly produced. The copper wire was gradually separated from the brass ring until the arc of light was broken. The greatest length of the arc was about 5 inches. As soon as the connexion was made between the opposite ends of the battery, by the

copper wire, which was $\frac{1}{4}$ of an inch thick, about 5 feet long, a loud noise was produced, by the combustion of the solder which fastened some of the copper slips to the zinc plates. I immediately went to the part of the battery from which the noise proceeded, in order to try whether the connexion between the cast iron cells and zinc plates was broken; I found one slip of copper detached from the zinc plate to which it had been soldered. There were probably others disconnected with their zinc plates, but I did not find them. The result of this experiment showed that the turkey conducted only a part of the current circulated by the battery, for the current which killed the turkey, produced no combustion of the solder by which the copper slips were attached to the zinc plates.

We next tried the ignition of charcoal points. We were not able to determine the length of the arc of light between them; for before Sir Robert Kane had time to separate them, they were burned away. The light was, of course, most brilliant; the charcoal scintillated like steel or iron. I never before observed these scintillations in the combustion of charcoal. Coke points were also ignited, and a most intense light produced; but during the experiments with the coke points, the circuit was interrupted, in consequence of the fracture of one of the porous cells, which caused the dilute and concentrated acids to mingle together, and, consequently, to boil over, until the porous and cast iron cells were nearly emptied. Notwithstanding this interruption of the circuit, the arc of light between the coke points was about an inch long, and the heat of the flame deflagrated a file.

I had arrangements made for a long series of experiments on the decomposing power of the voltaic current, and of voltaic heat, and on the illuminating power of the various kinds of voltaic light; but these experiments I was obliged to omit, through fatigue, exhaustion, and bad health. I have since tried the illuminating power of the light produced by the ignition of coke points; and, for the gas microscope and polariscope, have found it far superior to the oxyhydrogen lime light. With good coke points, abundant light for the microscope and polariscope may be obtained from a battery containing 25 cast iron cells, and as many zinc plates, each 2 inches by four: if the coke be not very good, 40 plates will be required. When an iron cell, $2\frac{1}{2}$ inches wide, and 4 inches high, is large enough to contain between it and the porous cell, nearly a wine-glassful of the concentrated acids, the battery will work with undiminished power for about three hours, without any additional acid. If the cell containing the zinc plates be small, it will be necessary to pour in a little dilute acid every half hour. I have got the lime light by igniting the mixed gases, as they were produced by the decomposition of water, and throwing the flame on lime.

Maynooth College, April 6, 1848. Lond. Phil. Mag.

A New Method of Separating Magnesia from the Alkalies.

Heintz separates the magnesia from solutions containing potash and soda in the following manner:—

The solution containing the three bases is supersaturated with ammonia, and if it contain no chlorides, a few drops of sal ammoniac are added. Should a troubled appearance arise in the liquid, it is treated with sal ammoniac until this vanishes. The magnesia is then precipitated by phosphate of ammonia, the precipitate washed with ammoniacal water, dried, heated to redness, and weighed. The free ammonia in the filtrate having been partly removed by boiling, the phosphoric acid is precipitated at the boiling temperature, by nitrate or acetate of lead. When an excess of the lead salt has been used, a solution of carbonate of ammonia, containing free ammonia, is added to the hot liquid, which is then allowed to stand for some minutes. It is subsequently filtered, and the amount of potash and soda contained in the filtrate is ascertained by the usual methods.—*Pogg. Ann.* LXXIII. p. 119.

Quar. Jour. Lond. Chem. Soc.

On the Preparation of Prussian Blue, generally known as "Turnbull's Blue." *By* Robert Warington, Esq.

In bringing the present notice before the Society, I feel it necessary to apologize for introducing a subject to their attention which has been so ably investigated by many of our most eminent chemists, and the results of whose labors are to be found in the Chemical Manuals of the present day. Yet, when we find substances in commerce, under this title, or under the various magnified appellations of "Egyptian blue," "Cerulean blue," &c., differing exceedingly in character from each other, some of them of great beauty in color, and frequently possessing modified properties; when the difficulty attending the preparation of this blue of a uniform tint, which is a great source of annoyance to many of the makers, is also taken into consideration, I am induced to believe that the results of the investigation may not be deemed uninteresting to the members of this Society, or unimportant to the manufacturing chemist. The greater part of the experiments were made in the year 1834, and many of them have been lately repeated; the investigation has also been extended, for the purpose of confirmation, before being submitted to the Society.

I must premise, that the great object in view in commencing this investigation, was the production of a color analogous to what was then known as "Turnbull's blue," and was, at the period I allude to, made, I believe, only by the firm of Turnbull and Ramsay, of Glasgow; its extreme beauty, and the bright, metallic, coppery lustre exhibited on its surface, will be well known to most of our members. I need hardly say that numerous unsuccessful experiments were made, before anything approaching the desired tint was obtained. Its attempted production from a persalt of iron, by various and modified processes, was unsuccessful in every case; nothing comparable with it in lustre or beauty was obtained. After trying the different persalts of iron, the method of peroxidizing the protosalt was varied, and this was followed by the action of the ferridcyanide of potassium on the protosalt, in place of the ferrocyanide on the persalt, but the result was still not perfectly satisfactory.

In the course of these experiments, however, certain points were noted, which ultimately led the way to the desired result; one of the principal of these, and that which bears most fully on the present subject, was the fact, that the precipitate produced by a solution of the ferrocyanide of potassium, in the solution of a protosalt of iron, has a most powerful affinity for oxygen; every one must be aware of this to a certain extent, inasmuch as the precipitate absorbs oxygen from the air, and becomes deepened in color; but so energetic is this attraction, that many solutions of the salts of metallic oxides are deoxidized rapidly and perfectly, when brought within the sphere of its action; many of the blue salts of copper are rendered colorless, salts of chromic acid are reduced to salts of the green oxide, sufficient acid being present to hold in solution the protoxide of chromium which is produced; salts of peroxide of tin, mercury, and iron, are also rapidly reduced to the state of protosalts.*

The precipitate, in either of these cases, darkens and becomes gradually of a deep blue color, which is more or less intense as the quantity of the metallic salt, or the proportion of oxygen contained in it, varies; the fine, metallic, coppery lustre is at length gradually developed.—As this effect could thus be produced by salts of a metallic oxide, there was no apparent reason why the same result should not be arrived at with solutions of other agents containing oxygen, either in large quantity or feebly combined, as, for instance, in chloric acid and its salts, and in chlorous acid.

Another point was also rendered evident from the above experiments, namely, that it was actually necessary that the precipitate formed in the protosalt of iron by ferrocyanide of potassium, should first be produced, in order to obtain the state of molecular aggregation in the compound, capable of yielding a blue of the fine color and lustre sought, and upon which, as a basis, the effect of oxidizing agents could be fully developed. The composition of this precipitate, or white Prussian blue, has been pretty well ascertained by numerous investigators, and is represented by the formula:

$$2\,(Cy_3\,Fe)+Fe_3+K, \text{ or } Cy_6\,Fe_5+K.$$

It is produced by the action of two equivalents of the ferrocyanide of potassium, upon three equivalents of the protosulphate of iron; thus:

$$3\,(Fe\,O, SO_3)+2\,(Cy_3\,Fe, K_2) \text{ give rise to}$$

$$3\,(KO, SO_3)+2\,(Cy_3\,Fe)+Fe_3+K,$$

or sulphate of potash and the white Prussian blue.

* I may mention here that this re-action with the salts of iron affords an excellent means of securing a solution of this metal, in the state of protoxide, for the purpose of exhibiting its peculiar re-actions in the class room, experiments which are, at times, attended with some little annoyance. For this purpose, a solution of the ordinary proto-sulphate of iron is to be partially precipitated, in a well-corked or stoppered bottle, by a solution of the ferrocyanide of potassium, and the precipitate allowed to subside; it will then be found that this precipitate has reduced the remaining part of the solution to the state of protosulphate most perfectly, and that this is now capable of yielding a pure white precipitate, both with solutions of the carbonated alkalies and with additional solution of the ferrocyanide of potassium. The same effect may be produced by adding a portion of the recently precipitated ferrocyanide of iron to a solution of sulphate of iron.

Now the question arises, as to what chemical action takes place during the darkening in color, or oxidation of this compound, through the medium of oxidizing agents, and I shall presently be able to show, that it is the conversion of the equivalent of potassium, which forms one of its ingredients, into potash, and the removal of the potash at the same time, by the agency of an acid, with which it is able to combine. I have already shewn that there are various agents by which this oxidation may be effected; those which I have found to answer the purpose most efficiently, are: 1st, the bichromate of potash; 2d, the chlorate of potash; 3d, a soluble persalt of iron; 4th, chlorinated soda, or a solution of chloride of lime.

When bichromate of potash is employed, it is necessary to use one-third of an equivalent only, as the salt will afford three equivalents of available oxygen, and to effect our object perfectly, one only is required; thus,

$$KO, 2\,Cr\,O_3 + 4\,SO_3 \text{ will yield } (KO, SO_3 + Cr_2\,O_3, 3\,SO_3) + O_3$$

or one equivalent of bichromate of potash, treated with four equivs. of sulphuric acid, will give rise to one equiv. of sulphate of chromium and potash, (chrome alum,) and three equivs. of oxygen, and as the single equivalent of potassium we wish to oxidize requires only one equiv. of oxygen, the third part of an equiv. of the bichromate will suffice for our purpose; an additional equivalent of sulphuric acid is, however, indispensable for the purpose of uniting with the potash resulting from this oxidation.

When chlorate of potash is used as the oxidizing agent, about one-fifth of an equivalent is sufficient for the oxidation, the requisite proportion of hydrochloric acid being added to decompose the salt, and set the chloric acid free; as in the former case, care must be taken that an eqivalent of sulphuric acid is present, to combine with the resulting potash. The same remarks will equally apply to the employment of chlorinated soda, or chloride of lime; the latter compound, however, is objectionable, from the sulphate of lime which is necessarily produced when protosulphate of iron or sulphuric acid is made use of in the operation. In the third case, where a persalt of iron is the oxidizing medium, and in these experiments I have always employed the persulphate, the preparation of which will be immediately described, a single equivalent is necessary to yield the one equiv. of oxygen, and sufficient sulphuric acid is contained in this solution to combine with the oxidized potassium, after the iron has been reduced to the state of protoxide, by the action of the white Prussian blue; thus,

$$Fe_2\,O_3, 3\,SO_3 = 2\,(Fe\,O, SO_3) + O + SO_3.$$

That this action is owing to the oxidation and subsequent removal of the equivalent of potassium, will, I think, be evident from the fact, that when the bichromate of potash is employed in the proportion stated, the supernatant liquor has the pinkish-blue color of the double sulphate of chromium and potash; but if more than this be used, a portion of bichromate remains in solution, exhibiting its characteristic orange color. The same remarks apply to the persalt of iron, any excess above the equivalent required, being found in the filtrate or supernatant liquor, when the Prussian blue has subsided.

To prepare the persulphate of iron, I have found that either bichromate of potash, or chlorate of potash, may be employed with much greater advantage than nitric acid; care must be taken that sufficient sulphuric acid is present to hold the peroxide of iron produced in solution; and also, in the first case, to form chrome alum with the deoxidized chromic acid; the decomposition of the chlorate of potash should always be effected by hydrochloric acid. Now as the protosulphate of iron assumes an additional half equivalent of oxygen, to form persulphate, it will be evident that one-sixth of an equivalent of bichromate of potash, or one-tenth of an equivalent of chlorate of potash, with the requisite proportion of acid, will be sufficient for this conversion. When the oxidizing solution is prepared with chlorate of potash, the solution, after the oxidation of the white Prussian blue, may be precipitated by ferrocyanide of potassium for a future operation; if bichromate has been used, the protoxide of chromium will, to a certain extent, be precipitated by the ferrocyanide of potassium, and interfere with the brilliancy of the subsequent color.

The white Prussian blue should be precipitated from dilute solutions, in order to obtain an uniform product in the proper state of aggregation. I find that when the materials are respectively dissolved in about ten times their weight of water, a very good result is obtained.

It is well known that when Turnbull's blue is digested in a solution of the ferrocyanide of potassium, a pale or white Prussian blue and ferridcyanide of potassium result; this is best effected by acting on one equivalent of the former with two of the latter, and the action may be illustrated thus:

$$2\,(Cy_3\,Fe),\,Fe_3 + 2\,(Cy_3\,Fe,\,K_2) = 2\,(Cy_3\,Fe),\,Fe_3,K + C_6\,Fe_2,\,K_3.$$

The result being one equivalent of white Prussian blue, and one equivalent of ferridcyanide of potassium.—*Proc. Lond. Chem. Soc.*

Ibid.

On the Estimation of Magnesia by Phosphate of Soda, and that of Phosphoric Acid by Magnesia.

The ordinary method of estimating the quantity of magnesia in solution, by means of tribasic phosphate of soda, is unobjectionable, when ammoniacal water is employed for washing the precipitate; but Weber has satisfactorily proved in the above Memoir, that phosphoric acid in the bibasic modification cannot be accurately determined by magnesia.

The phosphate of magnesia and ammonia, and the pyrophosphate of magnesia, are not precipitated entirely by ammonia from solution in hydrochloric acid; neither is pyrophosphoric acid completely precipitated by the solution of a magnesian salt, even in the presence of ammonia, or an ammoniacal salt. Only, after standing for several weeks in the presence of ammonia, is the bibasic acid converted into the tribasic modification, and rendered capable of forming an entirely insoluble compound with magnesia.

If, therefore, the phosphoric acid in any substance is to be estimated

by magnesia, it must first be ascertained by means of nitrate of silver, whether the acid exist in it in the tribasic or bibasic modification. If the latter is the case, the substance must be fused with from 4 to 6 parts of a mixture of equivalent quantities of carbonate of soda and potash, or treated for a length of time with concentrated sulphuric acid, by which means the bibasic acid and its compounds are converted into tribasic salts.

The pyrophosphates of lime, and the other alkaline earths, are, however, not entirely converted into tribasic phosphates by fusion with carbonated alkali; but by subsequent treatment with sulphuric acid and alcohol, the whole of the phosphoric acid may be obtained in the alcoholic solution. This must then be saturated with carbonate of soda, evaporated to dryness, and fused, in order to determine with accuracy the amount of phosphoric acid present.—*Pogg. Ann.* LXXIII. p. 137. Ibid.

On Steam Navigation. *By* M. LE BARON SEGUIER.

The best mode of propulsion for steam vessels has of late been the subject of much enquiry; and many truths have been elicited by the numerous experiments which have been undertaken. Paddle-wheels, (which were the first propellers adopted,) if their floats cease to propel while in contact with the water, will possess many and great disadvantages. Every time that (from the rolling of the vessel, or the action of the waves) a float, in a horizontal position, strikes the water, it does not act in a manner to propel the vessel forward, but tends to raise it; and the weight of the vessel being more than equal to the power which rotates the wheel, it will either be quite stopped, or its speed much slackened. An enormous amount of power is thus expended in retarding the progress of the vessel, instead of propelling it. Moreover, all the floats being fixed, when one of them, in rising out of the water, only possesses an angular speed, inferior to the momentum acquired by the vessel, the lower floats themselves become an obstacle to its forward progress; as, in that case, they must be added to the section of the vessel as a resisting surface. On suspending the action of the propeller, when it is desired to set the sails, and take advantage of a fair wind, the surface of the lower floats forms a constant resistance, added to that of the midships frame of the vessel. This serious evil can only be avoided, by throwing the wheels out of gear, and allowing them to run loosely; or by the tedious, and sometimes dangerous, operation of dismounting the floats from the lower part of the wheels:—this latter course is preferred.

In order to avoid the evident loss of power, caused by the floats of the wheels not acting uniformly as propellers during the whole time they are in contact with the water, it was proposed to make them movable, whereby they would be protected, whilst still in a horizontal position, from the shock of the waves; and, on leaving the water, they would rise without lifting backwater; but the advantages these mova-

ble paddles presented, were found to be counterbalanced by their comparative want of durability.

Many modifications have also been made in the wheels with fixed paddles; for instance, they have been inclined, and caused to enter the water in an oblique direction to the axis, in order that they may act under the water, according to the principle of White's gearing; they have also been divided in their length and depth, and set in various manners in epicycloïdal curves; wheels have likewise been made with curved floats, in the form of the flukes of an anchor; and floats, pierced with holes, but provided with an extra amount of surface, corresponding to the loss in such perforations, have been tried, to increase their resistance.

The defects of ordinary float-wheels are so manifest, especially at sea, that, ever since the application of steam to marine propelling, a great variety of propellers have been invented for the purpose of superseding their use. Among these are—endless chains furnished with a number of paddles, and running along the sides of the vessel, parallel with the keel; the action of a swan has been imitated, by the alternating motion of jointed rods furnished with blades; the oblique action of the tail of a fish has been imitated, by one or more blades being moved backwards and forwards at the stern; and by screws with one or more threads. This latter contrivance, which was proposed, as an hydraulic mover by Duquet, towards the middle of the last century, and as a propelling apparatus for steam vessels by Dallery, at the beginning of this century, and experimented upon, in all its combinations, by the constructor Sauvage, has not, however, met with approbation. The experiments to which the screw has been subjected, on a large scale, have brought out both its good qualities and defects. The undoubted advantages which it possesses are, simplicity, compactness, and lightness, and its adaptability to the sides or the after part of the vessel. With regard to its defects, they are of two kinds, some relating to its mode of action, and others to its position. The surface of the helix, which will necessarily be of limited dimensions, must, in order to find a sufficient *point d'appui* in the liquid, revolve with considerable speed; the water must, without having time to be displaced, oppose to it the *inertia* of its mass, without which the work will not be effectual. No successful result has been obtained with the helix, until, by means of powerful agents, a rotary motion was communicated to it, sufficiently rapid to cause the water to act as a female screw; the helix then acting as a screw in it, and having its *point d'appui* against the vessel, gave some idea of its power. Resistance being thus obtained in the water, the impulsion is necessarily transmitted to the vessel at a single point, viz: the extremity of the shaft; but here the defects of the helix become apparent; the resistance which the end of the shaft has to overcome, being equal to the power employed to move it, a rapid destruction of the mechanism and loss of power, owing to the friction, are the result. The impossibility, or, at least, the extreme difficulty of getting at the screw and the bearings of its shaft, in a great degree counterbalance the advantages of its submarine position. In consequence of its being placed at the stern of the vessel, a very long shaft is required to com-

municate with the engine, which is situated nearly in the centre; whereby considerable vibration is produced, which cannot be otherwise than prejudicial. When the vessel is sailing, the screw offers a continual obstacle to the progress of the vessel, even if thrown out of gear; but of all its disadvantages, the greatest is the impossibility of repairing this kind of propeller in case it should get out of order at sea.

M. Seguier having observed that steam navigation had not yet arrived at perfection, sought some means of more effectively combining the power of the wind with that of steam. These two modes of propelling may be combined without injury, and will, according to circumstances, produce either the sum of their united forces, or each one, separately, the product of its greatest power.

In order to attain these results, M. le Baron Seguier caused a small experimental vessel to be launched on the Seine, similar in form to the canoes used by Indians, and carrying telescope matting, half wood and half iron, and capable of being set at any required height; its propelling wheels were worked by a steam engine, and furnished with floats turning on pivots.

The idea of these movable floats is not new; in 1819 an iron boat, the "Aaron Manby," constructed in England, proved the disadvantages of a wheel constructed on that principle, when the floats do not work according to the mathematical rules laid down by M. Seguier. Mr. Buchanan, in America, and M. Sciardo, in France, had both the same idea; but they probably did not sufficiently take into consideration the fact, that to ensure the proper action of such propellers, and also their durability, their movements must be so arranged, that the floats shall pivot at their minimum speed, at the beginning and end of every such movement.

The floats on M. Seguier's wheel are independent, and turn on their pivots, which are radial, and work in long bearings of hard metal; the crank with which their axis is furnished, causes them easily to follow a directing curve, which has no other resistance to overcome than the simple friction of the axes or pivots of the float. This curve is adjustable, in order to vary the time of its action on the floats. These floats, being prepared, by a slight deviation of position, for the angular movement which they continually receive from the water upon which they act, give way instead of resisting. All shocks are avoided, by the care which M. Seguier has taken in tracing the directing curve, so as to guide the float, and stop it at its minimum speed. It is this property of the wheel to which M. Seguier attaches the greatest importance, as it is that alone which ensures its durability.

The wheel may be of any size, and several rows of floats, placed in juxta-position, may be guided by one directing curve, so as to move simultaneously; for this purpose it is only necessary to unite all those composing one row by a common rod. By causing the float thus to move in a radial direction, a great advantage is obtained, viz,—that of presenting its edge to the water whenever the movement of the vessel or the water shall be such as to have a tendency to retard the motion of the wheel.

In his directing curve, M. Seguier has substituted for the ordinary

friction of the collar of the eccentric, a rolling friction, by means of friction rollers.

When this wheel is at rest, owing to its floats being able to pivot, the wheel becomes a kind of lee-board, when the directing curve has been so adjusted as to cause the lower floats to assume a position in a line with the keel of the vessel. This much facilitates the progress of the vessel under sail, especially if it is not provided with a high keel, and draws but little water.

M. Seguier's vessel, (the lines of which were laid down by M. de la Morinière, ex-engineer in chief of the Navy,) may be propelled either by the wind and steam combined, or by either separately.—*Bulletin de la Société d'Encouragement.* Lond. Journ. Arts & Sci.

On an Easy Method of Measuring the Distance and Height of an Elevated Point, Accessible or Inaccessible, Fixed or Movable, by Means of a Single Instrument, and by taking the Observation from only one Station. By M. Elie Wartmann, *Professor of Physics in the Academy of Geneva.**

Geodesical and astronomical operations very frequently require the knowledge of the distance of a remote object. If the object be fixed, the ordinary processes of trigonometry readily lead to the desired result. It is only necessary to determine a base, and to measure, from each of its extremities, the angle between the other extremity and the object; we thus obtain the value of two angles and of the adjacent side, from which the triangle is easily resolved.

But for the case in which the distant object is in motion—a case of great importance, and which occurs in several strategical and cosmological problems, the operation is by no means so simple. It would be necessary first to measure a straight line, more or less extended, and to station at its extremities two observers, who at the same instant should direct the telescopes of their theodolites to the same point of the object. When the point is simultaneously visible from the two stations, and the chronometers compared, and when, above all, the object preserves exactly its form, or only changes it imperceptibly, it is conceivable that this method may succeed; and the result will be more exact as the readings are repeated at shorter intervals, in order to lessen the probable errors by means. But when these different circumstances do not exist, when there is only a single observer, or the object varies in appearance, or is not visible at the same time from both extremities of the base, then the execution of the process becomes impossible.

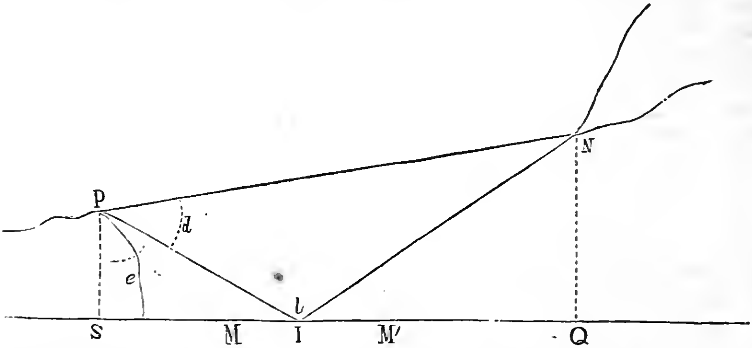
Such are the objections which may be made to the method proposed by M. Pouillet† for estimating the *height of the clouds*, a problem which

* Bulletin of the Sittings of the Vaudois Society of Natural Sciences, tome i. p. 21. (Sitting of February 2, 1842.) See also Pogg. Ann., tome lvi. p. 635; and Gehler's Physikalisches Wörterbuch, tom. xi. p. 700.

† Note on the Height, Velocity, and Direction of the Clouds; Comptes Rendus de l'Academie des Sciences, Paris, tom. xi. p. 717, (Nov. 9, 1840.)

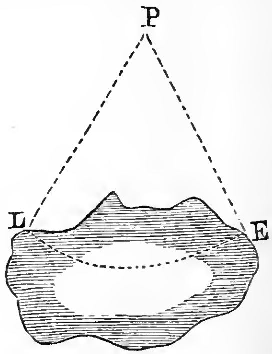
has already attracted the attention of several eminent philosophers, such as James Bernoulli,* Brice,† Lambert,‡ and more recently M. Arago.§ The following is the method which I propose for its solution.

Let us select in a motionless cloud, or in one which does not move with too great velocity, any point N, fig. 1, distinguishable by its color



or peculiar form. Let us place ourselves on an elevated point P, on the summit of a hill or tower, or even at the window of the upper story of a house. Let us have under us a reflecting plane MM', such as a tranquil surface of water or mercury, or a large horizontal glass. The angle of incidence of a luminous ray which strikes a mirror being equal to the angle of reflection, it will suffice to determine the angle *d* formed by the ray which reaches the eye directly from the point N, with the ray PI which reaches it by reflexion in I, and to estimate the length PI, in order to solve the problem.

In fact, calling *e* the angle formed by the reflected ray PI with the vertical PS, which passes through the centre of the instrument with which the angle is taken, it is evident that the angle *l* contained by the incident and reflected rays$=2e$. The two angles *d* and *l* being known, it only remains to measure PI. As it might be difficult to determine precisely the point I of the reflecting surface, we may turn the telescope round the vertical, keeping the angle *e* constant, and seek the length PL or PE of the line joining the point P with the object L or E situated on its margin, (fig. 2.) If the observer is on the top of a vertical wall, or on a tower or house, he will only have to measure its height above the reflecting plane PS$=h$ to deduce



$$PI=\frac{PS}{\cos e}=\frac{h}{\cos e}.$$

* Acta Eruditorum, 1688. † Philosophical Transactions, 1766.

‡ Memoirs of the Academy of Berlin, 1773.

§ Comptes Rendus, tom. xi. p. 323, (August 24, 1840.) Annual of the Bureau on Longitudes, 1840, p. 316.

This value being known, we deduce from it

$$h = \mathrm{PI} \cos e.$$

In like manner since the incident ray

$$\mathrm{IN} = \mathrm{PI} \frac{\sin d}{\sin (d+l)},$$

therefore the vertical height NQ=H of the cloud above the mirror is

$$\mathrm{H} = \mathrm{IN} \cos e = h \frac{\sin d}{\sin (d+l)},$$

and its height $\Delta = \mathrm{H} - h$ above the observer

$$\Delta = h \left\{ \frac{\sin d}{\sin (d+l)} - 1 \right\}.$$

It is sufficient in practice to employ a circle placed vertically and furnished with a tube without lenses. A metallic plate, blackened, and pierced at its centre with a small hole, serves instead of an eye-glass. The tube, the interior of which is likewise black, is furnished with cross wires, and a sufficient length is given it to admit only the useful rays, and not those which are reflected by objects surrounding the point which is observed. The reflecting surface may be a pond, a lake, a large sheet of water, or mercury, &c.

Besides its simplicity, the process which I have described, and which evidently applies in the same cases as the other methods which have been proposed, appears to me to offer some advantages over them.—It is absolutely independent of the presence of the sun above the horizon. The larger the base to be measured PI, the greater will be the approximation. If the point N is only slowly moved, we may employ Borda's method for the repetition of the angles, and thus limit more nearly their exact value: we may, moreover, observe at short intervals of time, and determine the velocity of translation of the object,—a circumstance which it is often useful to ascertain. We remark, lastly, that there is no longer any possibility for a single observer to confound the point of vision with other surrounding points. Now this confusion frequently occurs in the case of a fleeting cloud, and which requires less time to lose its form than is required, in M. Pouillet's method, for two observers to regain their post and observe, after having met to make their arrangements.

If the wind or any other cause prevents the employment of a liquid as the mirror, a very smooth silvered glass might be substituted, of as large dimensions as possible, and be placed horizontally by means of levels or screws, or thin wedges.

Professor Whewell has very recently proposed* to ascertain the height of the clouds, or of a mountain, by means of the formula

$$\mathrm{H} = h \cdot \frac{\sin (\alpha + \beta)}{\sin (\alpha - \beta)},$$

in which

H is the height of the cloud above a horizontal mirror,

h the vertical height of the observer above this mirror,

* Reports of the British Association for 1846; Transactions of the Sections, p. 15.

α the angle of depression of the image of any point of the cloud below the horizontal plane passing by the eye of the observer,

β the angle of elevation of the same point above this plane.

It is evident that this formula is identical with that* which I published four years ago, and which has been reproduced in the scientific journals of Germany. The learned Master of Trinity forgot that, at the time when he made his communication to the Section of Physics of the British Association, at Southampton, I informed him that what he proposed as new was already in print.

Lond. Edin. & Dub. Phil. Mag.

Account of the Cost and Durability of Banks's Patent Steel Tyres for Railway Wheels.

Mr. Fothergill read the following paper before the Institution of Mechanical Engineers, Birmingham. The statement of facts relative to Mr. Thomas Banks's patent plan† of steeling the tyres of Railway wheels, is the result of nearly five years' trial, and shows the cost and durability of Staffordshire tyres, steeled on his plan, as compared with Low Moor tyres.

The present cost of Low Moor tyres, for 3-feet wheels, will be—

	£	s.	d.
Four tyres of 3 cwt. each—12 cwt., at 22*s.*	£13	4	0
Putting on the tyres ready for work,	8	0	0
Twice turning up, after wearing hollow,	1	0	0
Total cost,	£22	4	0

Suppose these tyres to run 50,000 miles on an average—that is, 50,000 miles at a cost of £22 4*s.*

The present cost of Staffordshire tyres will be—

	£	s.	d.
Four tyres of 3 cwt. each—12 cwt., at 12*s.*	£7	4	0
Putting on the tyres ready for work,	8	0	0
Steel for steeling one set—1½ cwt., at 42*s.*	3	3	0
Man's wages, for turning grooves in the wheels,	0	10	0
Smith's wages, for inserting the steel,	0	10	0
Man's wages, for turning up after steeling,	0	10	0
Men's wages, for drilling and rivetting,	0	7	6
Total cost,	£20	4	6

These tyres are proved to run, before steeling, 18,000 miles, and after steeling, 100,000 miles—making a total work of 118,000 miles, at a cost of £20 4*s.* 6*d.* Now subtracting 50,000 miles—the work of Low Moor tyres—from 118,000—the work of Staffordshire tyres steeled—we have 68,000 miles, which the latter will run more than the former, and at a cost of 39*s.* 6*d.* per set less. From the above statement, we see the cost of Low Moor tyres per 1000 miles, is 8*s.* 10½*d.*; whilst the cost of Staffordshire tyres, steeled, is only 3*s.* 5¾*d.* per 1000 miles. The truth of this statement is proved by a test of nearly five years' trial, on those lines on which the plan has been most used. We are

* Reports of the British Association for 1846; Transactions of the Sections, p. 15.

† For the specification, See Journ. Frank. Inst., 3rd Series, Vol. vi, p. 212.

aware that railways do not all wear out the tyres alike; but on those lines where the iron tyres will run more than stated above, the steeled tyres will run more in proportion, and the plan is attended with no danger whatever.

Note.—The above statement shows only the advantage of steeling the tyres once, but we have steeled many a second time, after they have run the above distance. The same tyres may be steeled a second time at a cost of £5 per set, when they will run 100,000 miles more—making a total of 218,000, at a cost of £25 4*s.* 6*d.*, or 2*s.* 4*d.* per 1000 miles. The advantage of steeling a second time is secured by taking the tyres in time, while they have the requisite strength for steeling the first time. The general objection against the plan is, that there will be a deal of trouble to carry it out; but this objection, if properly examined, will be found to be without foundation. When the wheels want turning up, they must be taken from under the carriage, or wagon; and, when taken from under, the cutting of the grooves in the tyres, for the steel, will not cost more than 5*s.* per pair in men's wages; and, when the grooves are turned, one smith and three strikers will insert steel segments with 10 pairs of 3-feet wheels in one day of 10 hours; after which, turning up the steeled wheels will take very little more time than turning up without steeling, which proves that the trouble will not be so great as some people imagine, and nothing, when the durability and saving which is effected is considered, by the tyres being steeled on this plan.

The paper was accompanied by a letter from Mr. Jenkins of the Manchester and Leeds Railway, highly commendatory of the steel tyres.

Mr. Peacock remarked, that he had tried the wheels steeled by Mr. Banks's process, and the result was, that whereas he was formerly obliged to repair the wheels of the tenders every four months, those with steel tyres did not require repair oftener than once in 12 months. He had not fully tested their wearing qualities, but he had no doubt that they would be found to be most economical as well as useful.—Several other of the members spoke in high terms of the value of this patent. Civ. Eng. & Arch. Journ.

Remarks on some of the Applications of Chemistry to Geological Research. *By* Prof. Daubeny.

The lecturer first noticed the phenomena of metamorphic action in rocks as requiring the aid of chemistry for their explanation. The formation of mineral veins belongs to this subject, and may be elucidated by two principles that have been pointed out by chemistry: viz. 1. That igneous rocks contain frequently disseminated through them infinitesimal quantities of most of the metals which exist in mineral veins. 2. That the latter are convertible into vapor at a temperature below their freezing point. After stating facts that lend support to both these principles, the lecturer pointed out their bearings upon the aggregation in veins of mineral matter derived from rocks that had

been subjected to long-continued heat, and concluded that their occurrence in the neighborhood of plutonic and volcanic rocks might thus be accounted for. Another effect attributed to metamorphic action is the formation of Dolomites. Here carbonate of magnesia appears to take the place of carbonate of lime without actual fusion having occurred to produce it, since the organic structure of the fossils is often preserved in rocks so altered. Although the cause was different, the effect seemed analogous to that which has happened to certain sponges, &c.. in the greensand near Farnham; where, according to a recent discovery, phosphate of lime appears to have taken the place of a portion of the carbonate with which the marine production was at first fossilized. The theory proposed by the lecturer, in short, differed chiefly from that of Von Buch in his supposing the magnesia to have been derived from other parts of the limestone formation, instead of the igneous rock injected. After recommending fresh experiments to be instituted for the purpose of setting at rest the question relating to the possibility of an actual transference of magnesia from place to place, the lecturer proceeded to point out the necessity of chemistry for the elucidation of the phenomena produced by igneous causes at the present day. He alluded to the various chemical phenomena which present themselves during the several *phases* of volcanic action, all of which ought to be kept in view by those who pretend to give a theory as to its cause. He pointed out the discovery of Mr. Grove, that heat is capable of overpowering the strongest affinities, as corroborative of the chemical theory by showing that if a temperature ever existed which was sufficient to render the most infusible bodies liquid, the elements of matter would probably have been at the time uncombined, so that when any portion of them sunk below that point, the very same chemical action must have commenced which this theory supposes to be going on at present. The absence of lime and magnesia from granite, and the redundance of silica in it, are also in accordance with this theory; and so, likewise, is the detection by Pella of flames issuing from Vesuvius, as the emission of hydrogen from volcanoes appears thereby substantiated. The lecturer then pointed out some of the final causes of the processes alluded to—as, for example, the offices discharged by the carbonic acid evolved from the earth in decomposing rocks and liberating their fertilizing materials, in the production of new limestone rocks on the surface to compensate for those converted into silicates by volcanic heat in the interior, and in the restoration of the purity of the atmosphere by supplying oxygen through its decomposition by plants. He also alluded to the accumulation in veins of the several metals through metamorphic action, without which, owing to their comparatively minute quantity, they could never have been recognised by man; whilst those bodies which, like phosphates, are essential to organization occur almost universally diffused. The lecturer concluded by entreating his hearers to call in to the elucidation of geological phenomena the assistance of chemistry, as a science which may be regarded as the grammar to the language of Nature—the key to unlock the most hidden of her mysteries.—*Proc. Roy. Inst., March* 24, 1848.

London Athenæum.

STATISTICS.

Notice of the Sardinian Exhibition of the Products of Industry, by M. Bonafous.—*Translated for the Journal of the Franklin Institute.*—The work which I have the honor to present is compiled by M. le Chev. Giulio in the name of the Royal Chamber of Agriculture and Commerce, and presents a classified table of the products of Sardinian industry admitted to the public exhibition which took place last year at Turin, with a list of the recompenses awarded to the most deserving of the exhibitors. I shall confine myself to noticing only a few of the arts.

There are at present worked in the kingdom of Sardinia, 28 mines of iron ore, which employ from 3000 to 4000 workmen, and produce 80,000 quint. metriq. of iron, value, 4,000,000 frs. ($800,000.) This product not being sufficient for the consumption, the rich Elba ore, and charcoal from Tuscany are transported to several points on the shore of the Mediterranean to supply other works, in which they prepare 30,000 quintals of iron by the direct method, which in France is called the Catalonian, in Italy the Ligurian process.

Add to this 8000 quintals of wrought, and 30,000 quintals of cast iron, and we get the amount consumed.

The establishments of this country also produce steels of a remarkable temper. In the exhibition of 1844, there were files which promised competition with those of Styria and of England. The iron wire, and hollow-ware also attracted attention. There are three mines of argentiferous lead, those of Pesey and Macot in the Tarentaise; those of Saint-Jean-de-Maurienne and of Tenda, produce only a mean value of 300,000 francs yearly. ($56,000.)

From 25 workings for gold only 500,000 francs are produced. ($93,500.)

Several copper mines are also but feebly worked.

Three mines of manganese furnish 35,000 kilogrammes of peroxide (34½ tons) fit for the manufacture of chlorine for bleaching linen and cotton goods.

Two mines of cobalt are neglected.

The pottery is almost entirely abandoned to the peasants. Yet about 100,000,000 pieces of bricks and tiles are produced, of which about one-tenth part is exported.

No glass is as yet made in the Sardinian states, but several manufactories of flint and bottle glass are in progress.

The chemical products amount annually to 300,000 francs. ($56,000.)

The Genoese paper a century ago was celebrated everywhere. At present, since England, and especially France, have paid attention to this article, it is only in Spain, Portugal, and South America, that the paper of Genoa is consumed.

Sardinian industry furnishes from 3 to 4,000,000 kilog. (3000 to 4000 tons) of leather coming from 8 or 9,000,000 raw hides, of which one-fourth are imported.

Silk holds the third rank in the scale of agricultural or national products of the kingdom after grain and wine, and is the most important object of commerce of the country. The annual production is estimated at 600,000 kil. (1,322,842 lbs.) of silk, having a value of about 38,000,000 francs. ($7,000,000.)

The silk-spinning establishments are about 1000, and employ 65,000 persons of all ages. Were it not for the loss caused by the *muscardine** in the cocooneries, this act would suffice of itself to pay the whole expenses of the government.

The cotton trade furnishes about 6,000,000 francs ($1,122,000) of spun-cotton, and employs more than 5000 workmen.

The woolen business, notwithstanding the competition of foreign cloths, which get access indirectly to the country, furnishes more than 1,540,000 metres (1,680,000 yds.) of stuffs of all qualities. To add to its importance, this manufacture awaits the time when it shall be freed from the necessity of using foreign wool.

Exports of Iron from Great Britain to the United States.—It will be observed, from a reference to the following table, that British exports to the United States have increased very much during the past year, expecially in the finer descriptions of iron. The shipments from Wales, direct to the United States, have also been much in advance of any former year. To India her exports have again been light.

Exports of Iron from Liverpool in 1846–7, to New York, Boston, and Philadelphia.

	Rails.	Bars.	Hoops & Sheets.
To New York, in 1846,	6,440	7,026	901
" in 1847,	6,642	20,546	4,355
Increase,	202	13,520	3,954
To Boston, in 1846,	6,030	4,114	623
" in 1847,	5,843	13,583	1,670
Increase,	....	9,469	1,047
To Philadelphia, in 1846,	44	1,667	162
" in 1847,	150	3,414	670
Increase,	106	1,747	508

Hunt's Merch. Mag.

Statistics of Railroads.—End of 1847, 1,395 miles of rail had been opened in France, 3,891 in Germany, 546 in Belgium, 342 in Italy, about 250 in Hungary, 213 in Poland, 183 in Holland, 138 in Denmark, 51 in all Russia, and 18 in Switzerland. Lond. Builder.

Gas Statistics.—It was stated by Dr. A. W. Hofman, in a recent

* A disease of the silk worm—a kind of mould or mouldiness which destroys it.

lecture at the Royal College of Chemistry, Hanover Square, on the composition of coal gas and its combustion, that in England nearly 6,000,000 tons of coal are annually consumed in the manufacture of gas, and from £12,000,000 to £15,000,000 employed in its production. In London alone 500,000 tons of coal are annually used, producing 4,500,000,000 cubic feet of gas, and 500,000 chaldrons of coke; of the latter 120,000 chaldrons are consumed in manufacturing the gas, and the remainder is sent into the market for fuel. The number of houses burning gas in London is more than half a million, and the length of the mains is upwards of 1,500 miles. **Ibid.**

Land in England—The whole area of England is equal to 50,387 square miles, or 32,247,680 statute acres: thus divided—arable land, 13,252,000; pasture, 12,380,000; and uncultivated, 6,615,680=32,-247,680 acres. **Lond. Min. Journ.**

The State of Pennsylvania contains nearly 47,000 square miles, or 30,080,000 acres of land.

Produce of Gold in Russia.—Accounts from St. Petersburg give a summary of the returns of gold delivered from the mines of the Ural Mountains, during the half-year, ending the 31st December last. The quantity of gold produced in the royal mines during that period had been 60 puds. 27 lbs. 77 sol. 79 parts. The private mines had produced 101 puds. 24 lbs. 1 sol. 76 parts. The quantity of platina obtained from the Crown properties and from private mines had been 18 lbs. 92 sol. 17 parts. The royal and private mines in the Altai Mountains, and in East and West Siberia, had produced, in 1847, 1434 puds. 12 lbs. 57 sol. of gold; and the district of Nertschinskinche, 25 puds.,—making a total of 1780 puds. 37 lbs. 69 sol., for the year, 1847, independently of the silver obtained from the Altai Mountains and Nertschinskinche, which amounted altogether to 168 puds. 25 lbs. more than in 1846. **Ibid.**

Soap Returns.—By returns, just printed, obtained by Mr. Hutt, M. P., it appears that in the year ending the 5th of January last, 1,955,023 lbs. of silicated soap were made in Great Britain, 160,065,-641 lbs of other hard soap, and 14,279,425 lbs. of soft soap. In the same period, the quantity imported into Great Britain from Ireland was 170,249 lbs. of hard, and 2560 lbs. of soft soap. The amount of duty was £1128 9s. 2d. The number of licenses granted to soap-makers in the year was 316, of which 147 carried on business in England, 19 in Scotland, and 150 in Ireland. **Ibid.**

The Coal Fields in England and Wales.—A Ruabon correspondent in the *Chester Chronicle*, signing himself "Asbestos," says, that the North Wales coal-field, measuring from the point of Ayr, in Flintshire, to a few miles beyond Oswestry, in Shropshire, covers an area of 200 square miles, of 10 yards in thickness. The weight of a cubic

yard of compact coal is 19 cwts. 16 lbs. The total weight of the coal in this extensive area will thus be 5,929,690,000 tons. These coals at 6s. per ton, at the pit mouth, would produce £1,778,907,000. To exhaust this field it would require that 2,000,000 tons be worked annually for nearly three hundred years. The extent of the other coal-fields in England and South Wales, estimated at the same thickness as the North Wales fields, would yield 177,890,700,000 tons, which would furnish us with 40,000,000 tons of coals for nearly 4000 years. Ibid.

Coals, Cinders, and Culm.—A return has just been prepared, by order of the House of Commons, of the total quantities of coal, cinders, and culm exported from the United Kingdom to all parts of the world, in each year, from 1840 to 1847, both inclusive—distinguishing the quantities exported to the countries named below respectively, from those exported to all other parts. The total for the years 1840 and 1841 were respectively 1,606,313 tons, and 1,848,294 tons; the details of the remaining years are as follows:—

WHENCE EXPORTED.	1842.	1843.	1844.	1845.	1846.	1847.
Cuba, tons.	35,653	15,221	14,844	13,218	17,358	19,049
Chili,	1,877	1,840	8,219	15,149	8,664	9,680
Peru,	340	301	2,277	5,108	3,067	4,320
Columbia,	50	900	272	216	320	108
United States,	60,836	33,948	29,822	58,381	45,536	46,188
France,	515,975	462,941	412,902	647,967	670,035	641,010
Spain and Canaries,	53,548	64,009	74,836	101,336	104,286	97,509
Norway,	18.800	18,951	22,138	33,036	31,439	32.753
Sweden,	37.995	25,961	25.661	34,664	31,085	26.589
Russia,	83.582	116,041	94,144	150,422	138,485	108.378
All other parts,	1,190,848	1,126.098	1,069,056	1,471.785	1,480,833	1,497,577
Total.	1.999,504	1,866.211	1.754,171	2.531,282	2.531.108	2,483,161

Ibid.

The Export Coal Trade.—The official returns of exports, furnish, we are happy to perceive, satisfactory evidence as to the improvement of our export trade in coal—the declared value of that article having increased during the three months ending April 5th, 1848, to the extent of fully forty per cent. as compared with the corresponding period of 1847. A period of three months, however, is perhaps too small on which to found any sound calculations as to the state of trade; but on examining the returns for several months past, we find that a steady improvement has been going on, the following having been the total annual values during the last two years :=Year ending April 5, 1847, £926,084 ; year ending April 5, 1848, £1,047,766. It is true, that in 1845, very large shipments took place, the declared value for the 12 months ending April 5, 1846, having amounted to £1,031,700—a sum, nevertheless, which has been exceeded by the exports of the year ending the 5th of April last. This fact, we repeat, affords satisfactory evidence of improvement. Gateshead Observer. Ibid.

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PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1848.

CIVIL ENGINEERING.

Description of a Portable Cofferdam, adapted specially for the use of Harbor and other Marine Works in exposed situations. By THOMAS STEVENSON, F. R. S. E., F. R. S. S. A., Civ. Eng., *Edinburgh. Read before the Royal Scottish Society of Arts,* 10*th of January*, 1848.

When it is necessary, in the execution of marine works, to carry on founding or excavation in exposed situations within the high water-mark, cofferdams of the common description are not found to be answerable. Many circumstances conspire in rendering such erections inapplicable in situations where they are required to stand for several tides. The waves occasioned by a very moderate breeze of wind will, in many cases, even in the course of a few hours, either entirely break up a well-constructed cofferdam, or render it leaky and unserviceable. Again, where there happens to be a covering of a few feet of sand above a rocky bottom, the piles will be found, even where there is shelter from the waves, to have no stability, and to fall inwards as the sand is removed from the interior, although every care be taken to support them with *shores* or struts.

The temporary dams which are generally employed in the execution of tide-works are of a very simple construction, and are intended to be serviceable during only one or two tides. They consist of a row of short piles which are driven in the line of a runner or waling-piece, and as the excavation proceeds, the piles are from time to time driven further down. But this kind of erection is very unsatisfactory, and in

many situations, and for a variety of purposes, it is in fact quite useless; for I have always found that it was impossible, with this dam, to drive the piles straight, from there being only one waling-piece to direct them. But even although they could be driven, a farther source of inconvenience still remains, for, as the stuff is removed from the interior, there is nothing left but the single waling to resist the pressure from the outside, and the bottoms of the piles being speedily forced inwards, all attempts to carry the excavation farther must necessarily be abandoned.

At Hynish harbor, Argyllshire, in 1843, I had a talus-wall to found on sand, which covered a rocky beach to the depth of from two to three feet. At another place, the rock was not only to be bared, but a navigable channel, twenty feet wide, and in some places as deep as eight feet in the rock, together with a small tide-bason, were to be excavated to the level of the low-water springs. The shores also were frequently subject, even during the summer months, to a very heavy surf.

The excavation of the tide-bason, which formed the landward part of the work, was effected by means of a series of dams, consisting of walls, built of Pozzolano rubble. These were found to be quite watertight, and to answer remarkably well in every respect; but they required, for their protection against the waves, a considerable bulwark or breakwater of *Pierres perdues* to shelter them from the waves.

In the excavation, however, which had to be undertaken seaward of the breakwater of *Pierres perdues*, any attempt to exclude the water during the whole of the tide, was what I never considered practicable. A trial was accordingly made to effect the excavation by means of a low wall, composed of clay-rubble, resembling in its object those low dams consisting of logs of wood bedded in clay, which are often adopted in harbor works, and which are only intended to keep out the tide during the first part of the flood, and to be pumped dry before the operations of the next tide are begun. But after many attempts with this clay wall, it became quite evident that it would not be possible, with its assistance, to carry the excavations to near the level of low-water springs, which was due principally to two causes: *First*, because sand and shingle were, during almost every tide, washed in large quantities over the top of the wall into our excavation pit; and, *secondly*, because the waves washed out the clay from among the stones, so as to render the barrier no longer water-tight.

Being now compelled to set about some other way of carrying on the work, I had recourse to the simple method shortly to be explained, and which more than realized my expectations. Before giving a description of this method, however, it will be interesting, as well as still farther explanatory of the required objects, to quote a few lines relating to somewhat similar difficulties, from a Report upon the Harbor of Peterhead, which was drawn up in the year 1806 by the late Mr. John Rennie:—"The next material object of consideration," says the Report, "is that of deepening the harbor, which at present cannot well accommodate vessels drawing more than 12 feet of water in the spring tides, but in neaps is not sufficient. To render this harbor more ex-

tensively useful, it would be advisable to have 17 or 18 feet of water over the greatest part of its bottom, and particularly along the west quay. The mode of performing this kind of work will be different, according to the difference of situation. Those places where the tide ebbs from the surface, and continues so for some time, may be done by blasting, or by loosening the stones with quarrying tools in the usual manner; but *in those parts where the tide seldom leaves the bottom, and in others but for a short time, different methods must be resorted to.* The best of all would be enclosing large spaces by cofferdams, and working at all times of tide by quarrying tools or blasting, as might best suit; but in some situations this would be inconvenient, as the dams would be in the way of vessels going into and coming out of the harbor. In such situations, perhaps the simplest and most expeditious mode would be to use cast iron cylinders, of 7 or 8 feet diameter, having strong canvas fixed to the lower flanch, which might be kept to the bottom by bags of sand in places where there was but little agitation; but where there is much, an outer cylinder might be sunk thereon, to keep them in their situations."

The cylinders proposed by Mr. Rennie were, no doubt, quite adequate to the special purpose and locality for which they were designed, and they unquestionably possess some advantages not to be gained by other means; but, on the other hand, they are attended with difficulties and disadvantages which precluded their adoption in the present case. Those objections were the limited area, the weight and unwieldiness of such cylinders, their inflexible nature and unalterable form, as affording no means in themselves of adaptation to the very irregular rocky bottom which was to be excavated, and what was of as much consequence, the difficulty which must have attended the removal of the *partitions* of rock, or those parts which would necessarily be left between the different compartments of the cutting. The last two objections, it may be remarked, refer equally to wooden caissons, or other contrivances on the same principle.

In the present case, then, the following requisites were to be provided for. In the founding of the talus-wall, all that was required was some method which would enable the found-stones to be laid as deep in the sand as possible, for which purpose the dam did not require to be absolutely water-tight, provided it were capable of excluding from the inside the sand which was so liable to replace what was removed from the interior. For the excavation of the rock, on the other hand, it was necessary that the dam should be water-tight, and suitable for taking out all the partitions; and both situations required piles for fitting close to the irregular bottom, and those piles needed some support other than the soil into which they were to be driven.

To effect such objects, it was clear that the means to be adopted must be at once easily managed and efficient. For although, where there is time for their employment, many complicated and troublesome refinements of construction are forced to answer purposes which might have been attained by simpler means, or by less cumbrous arrangements, yet I was well aware that in the hurry and bustle attending tidal operations and night work, nothing can be tolerated but what is in every respect easily managed and truly efficient.

In the accompanying Diagrams, A G (Plate II.) represents a frame of double waling-pieces connected at the angles by the uprights I I, and bound together by the long bolts L, with forelocks and washers, while E F shews similar double-framed walings for the inside of the dam, and of smaller dimensions, with their uprights D, and connecting bolts K. These frames being placed in the required position, the one frame inside of the other, the piles, C, are driven down between them with heavy malls.

The dam was 12 feet long by 10 feet broad inside, so that five men were able to work in the interior.* If it was to be fixed within low water-mark, the two frames being placed in the water, were guided to the spot by the men in charge, and whenever they were in the desired position, the men at once moored or fixed the frames to the bottom, by driving down a pile at each corner. After this was done, all the piles were placed between the frames and driven down, and keyed up by the small piles called "closers." Four iron jumpers, J, were then driven down to their proper places outside of the frames, and edge planks for retaining the clay were slipped down upon the jumpers through iron staples, which were fixed to the planks. After this, good clay, (which should have some gravel mixed with it, to protect it from the wash of the sea,) was *punned* hard between the planks and the cofferdam, after which the mast N was erected, and the water taken out by means of the iron scoop shewn in the drawing, which not only was used in taking out the stuff, but proved far more efficacious than any pump we ever had. Indeed, to get the dam pumped dry, was for long the greatest difficulty we had to contend with. But Mr. William Downie, to whom I gave the charge, soon removed this difficulty, by using the scoop instead of a pump. The capacity of the scoop was about 37 gallons, and they generally made nine deliveries a minute, so that we found this method greatly more expeditious than any other.

As the excavation proceeded, the piles were from time to time driven down; and when the rising tide began to come over the pile heads, or to rise above the clay, the men, before leaving their work, placed the flooring or "*deck*," as it was called, within the piling, with the ends of the planks resting upon the top of the inner frame. On this deck, ballast (consisting of stones of a convenient size) was deposited, to prevent the whole frame from being floated-up,—the quantity so deposited varying with the height of tide, or appearance of the weather. As each compartment of the excavation was completed, and before the dam was removed, the rock below the two rows of piles which adjoined the next cuttings, was completely taken out, and the piles driven down to the bottom of the excavated pit, and left standing.† When the dam was taken up, the frames were, for the next compartment of

* Since this paper was printed, a cofferdam on the same principle, and 30 *feet square*, has been made for the Forth Navigation works, Stirling, where, in the removal of the "fords," under my direction, much difficulty has hitherto been experienced, from the constant flow of the river.

† Before lifting the cofferdam, the pit was filled with sand, to support the piles that were to remain, which, when the works were done, was cleared out by means of a water-scour provided for the purpose of keeping permanently open the navigable tract.

Mr. T. STEVENSON'S PORTABLE COFFERDAM.

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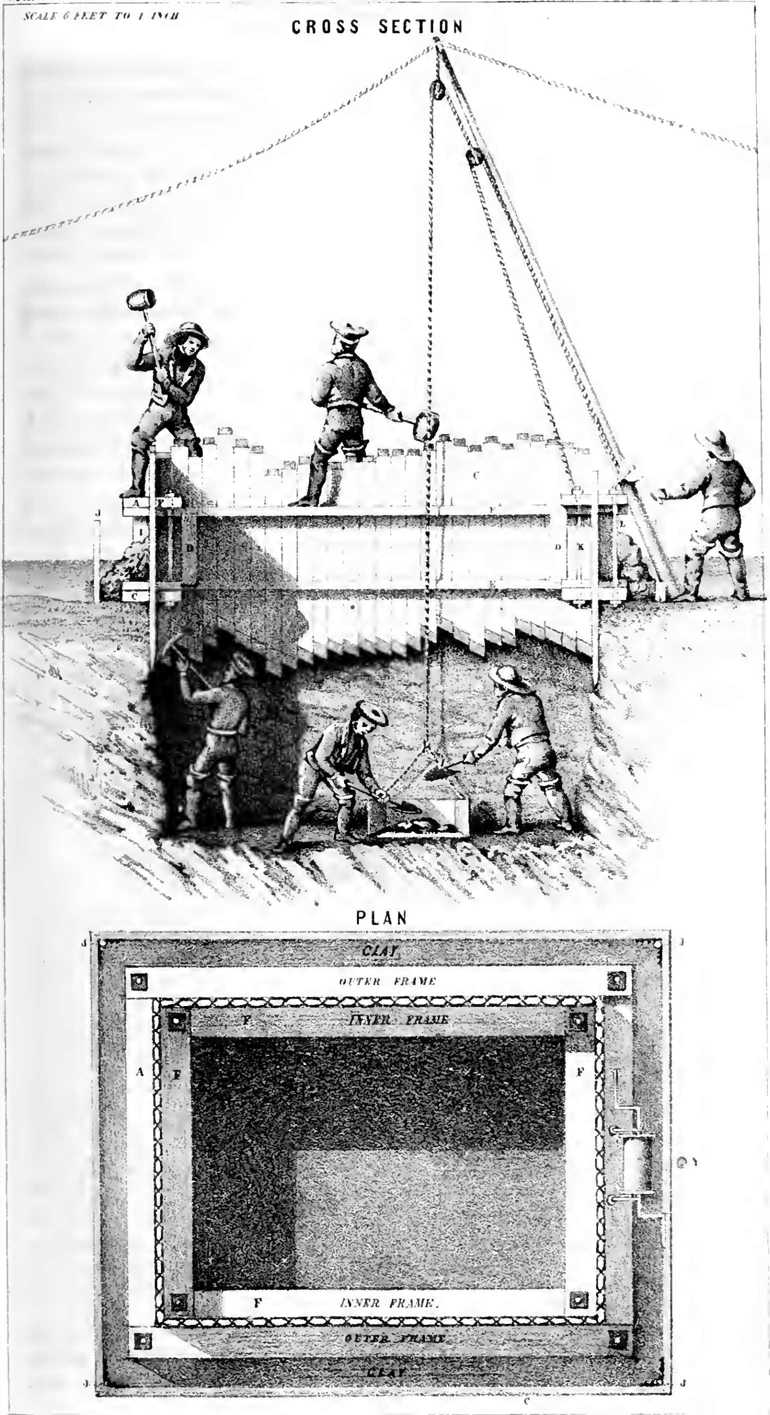

cutting, again superimposed upon one of the rows which had been left standing in the last pit. In this way no rock could possibly escape being removed; and when the frames were to be put down anew, there was no difficulty (although the pit was entirely covered with sand) in knowing exactly the position which they were to occupy, as the piles which had been left standing were an infallible guide.

The advantages peculiar to this description of dam are its cheapness,—its portability,—its ready adaptation to a sloping, or even to a very irregular bottom,—the ease and certainty with which the partitions between the different pits are removed, and the double-framed walings that support and direct the driving of the piles. Wherever excavations require to be made in a rocky beach, covered by a stratum of sand, however thin, there need not be any hesitation in adopting this form of dam, as there is no kind of lateral support, such as stays or shores, wanted, the structure containing within itself the elements necessary for its stability. It possesses, indeed, all the properties of a caisson, and has the farther advantage of accommodating itself to an irregular bottom.*

I may observe, in conclusion, that although this form of construction is specially adapted to marine works, in the execution of which it has proved a most valuable auxiliary, the same principle might also be carried to a greater extent, and be rendered fit, with little trouble, to answer for a variety of works,—such as underfooting quay walls, founding bridges, and in removing fords or other obstructions from the beds of rivers. The application of *a double-framed waling*, I have also found in itself a very useful application in several situations, and for a variety of purposes. Edin. New Phil. Journ. No. 89.

Speed and Power of the Locomotive. (Broad Gauge.)

The working of locomotives with ordinary passage trains is a much better indication of speed and power, and of the accommodation afforded to the public, than anything that can be gathered from a thousand experimental trips. We went down from Paddington to Swindon, one day, by the *Elk*—one of a broad-gauge class engines having 7-ft. driving-wheels, 16-in. cylinders, and 24 in. stroke. They are somewhat heavier than the class to which belongs the *Ixion*, so celebrated for her performances in the experiments instituted under the superintendence of the gauge commissioners. The fastest recorded trip ever made with a passenger train was from Paddington to Didcot (53 miles). The train taken was 50 tons weight, and the time 51 min. 38 sec. The engine employed was the *Lightning*, one of the 8-wheel engines, with 8-feet driving wheels, 18-in. cylinders, and 24-in. stroke. On another day the lighter engine, the *Elk*, driven by T. Simpson, a very careful and experienced man, left Paddington at 10·50·30, with the

* In situations, also, where there is a considerable depth of water, and where, consequently, the frames must be made so as to stand high above the ground, it will be found of great advantage to plank the outside of the frames between A and G. This will not only make the dam more water-tight, but have the effect of binding and strengthening the framework.

usual morning express, weighing 50 tons, and reached Didcot at 11·45·25, performing the 53 miles, therefore—from a state of rest to a state of rest—in 54 min. 55 sec.; a very excellent work indeed for this class of engine. Again, on another day, we went down by the 12 o'clock train. The trip was an extraordinary one. The train consisted of six carriages, two luggage vans, two carriage-trucks and one horse-box—together about 95 tons. The engine employed was the *Bright Star*, with 7-ft. driving wheels, 16-in. cylinder, and 18-in. stroke. She is a lighter engine than the *Elk*, and was built by Messrs. Stephenson. Her original consumption of coke was between 40 and 50 lbs. per mile, but she has been almost completely altered in her proportions. Her boiler has been lengthened, different cylinders put into her, the fire-box enlarged, the lap of the valve altered—in fact she has been made quite another engine at Swindon, and her consumption of coke now averages from 28 to 32 lbs. per mile. With a train of 95 tons, the *Bright Star*, driven by R. Patterson, one of the oldest and best drivers on the line, left Paddington at 12·3·10, and passed West Drayton (13 miles) at 12·20·27, having, therefore, got into speed with this heavy train, and run the 13 miles in 17 min. 17 sec. At the West Drayton station the caution signal was on, and the same signal was given by the policemen along the line till we came in sight of the Langley Marsh station (16 miles) where the red or danger signal was against the driver. As we approached the station the third class down train was seen about half a mile a-head. This we followed at a reduced rate of speed, and arrived at Slough at 12·28·47. The 18 miles were, therefore, gone over in 25 min. 37 sec., although we were kept back at a snail's pace for the couple of miles between Langley Marsh and Slough. The 13 miles from Slough to Twyford were—from station to station—performed in 17 min. 25 sec. With six stoppages, the train reached Swindon at 2·19·20, so that the 77 miles were performed in 2 h. 16 min. 30 sec. The time lost while the train was at a state of rest at the six stations—Slough, Twyford, Reading, Goring, Farringdon-road, and Didcot—was 24 min. 48 sec. The average speed, including all the stoppages, was 34 miles per hour. We believe there are not to be found on the narrow-gauge lines any two engines that would together equal this performance of the *Bright Star.*

London Artizan. No. 17.

Speed and Power of the Locomotive. (Narrow Gauge.)

Some exceedingly interesting and important experiments for testing the speed and power of two classes of recently constructed narrow-gauge locomotives, were made on the Midland Railway, on Thursday, Friday, and Saturday, May 4th, 5th, and 6th. The result of the experiments evidence considerable improvement in the speed and power of the narrow-gauge engines, since the trials instituted under the superintendence of the gauge commissioners, and furnish some exceedingly valuable data for the construction of useful passenger locomotives. The locomotives with which the experiments were made

are new classes, constructed by the old and well known manufacturers, Messrs. Sharpe, Brothers, & Co., of Manchester; and the modern, but enterprising, and scarcely less-known firm of Messrs. Wilson & Co., of Leeds. Two of Sharpe, Brothers, & Co.'s engines employed in the experiments, were No. 60 and 61. They are each of the following dimensions:—the number of tubes is 161, of 2 inches diameter outside, and 10 feet long. The heating surface is 847 feet, and the fire-box 72 square feet: The cylinder is 16 inches, the stroke 20 in., and the driving-wheel 5 feet 6 inches diameter. Two also of Messrs. Wilson & Co.'s engines—No. 26 and No. 27—were employed. They belong to what is called the "Jenny Lind" class. They have each 124 tubes, of 2 inches diameter outside, and 11 feet long. The heating surface is 800 feet, and the fire-box has 87 square feet. The driving-wheel is 6 feet diameter, and the length of stroke 20 inches. Mr. Kirtley, the locomotive superintendent to the Midland Company, conducted the experiments, which took place from the Derby to the Masborough station, about 40¼ miles. Engine No. 60 took the lead, with a gross weight of 100 tons, when the distance was gone over in little less than 49 minutes, or at the rate of about 49 miles per hour; and that the first 18 miles, up 1 in 330, were accomplished in 25 min. 12½ sec, or at an average speed of nearly 43 miles per hour. The steam of the engine was up 2 hours before starting and the water in the tender was, at the time the train left Derby, nearly at boiling heat. Coke consumed was 16 cwts., or 44 8 lbs. per inch, and water evaporated 10,290 lbs. or 257·2 lbs. per mile. "Jenny Lind," No. 27, with 103 tons, followed, performing the journey in 46 minutes, 22 seconds, or at the rate of nearly 52 miles per hour, the first 18 miles up 1 in 330, having been gone over in 22 minutes 44¾ seconds, or at the average rate of nearly 47 miles per hour. The total amount of coke consumed, including getting up steam, was 13 cwts., or 36·4 lbs. per mile. We are unable to state the quantity of water evaporated, the measurement not having been made with sufficient accuracy to warrant us in giving it. The next was the engine No. 61, with a train weighing 101 tons, and performing the distance in 54 min. 23 sec. The total consumption of coke was 16 cwts., or 44·8 lbs. per mile; and the water evaporated, 10,840 lbs., or 271 lbs. per mile. The quantity of water evaporated per lb. of coke was 6 lbs. In the parallel trip with the Messrs. Wilson & Co.'s engine, No. 26, the amount of coke consumed was 12 cwts., or 33·6 lbs. per mile, and the total water evaporated, 10,116 lbs., or 252·9 lbs. per mile. The water evaporated was 7·5 lbs. per lb. of coke—thus the *six feet driving-wheel engine* of Messrs. Wilson & Co., had traveled at an average speed of rather more than 40 miles per hour—viz.: in 20 min. 19 sec.—while the *five feet six inches driving-wheel engine* of Messrs. Sharpe, Brothers, and Co., went over the same ground in 27 min. 55 sec., or at the rate of 39·3 miles per hour. These are considered the best and most conclusive trips on the narrow-gauge line—saying much for the class of engines, No. 27, which performed the distance at an average rate of 52 miles per hour, as above; while an experiment with the *Great A*, an engine built by Mr. R. Stephenson, with only 50 tons, and much

better gradients, performed a like distance at a rate of only 47 miles per hour. **Lond. Min. Jour. No. 664.**

Resistance to Railway Trains.

Under the head of "Institution of Civil Engineers," in last week's Journal, we gave a report of the discussion on Mr. Gooch's paper on the above subject, on the 16th inst., the paper having been read on the 18th April. In consequence of Mr. Locke having, on the occasion, expressed himself thoroughly convinced that Mr. Brunel and Mr. Gooch were wrong in the belief entertained by them, that they could get a uniform speed of 50 to 60 miles per hour by gravity alone, down the Wootton Basset incline, which is one in one hundred, some carefully conducted experiments were made there on Friday and Saturday, last week. It has been generally assumed that a train, rtaveling at a rate of 36 miles per hour down such an incline, was the maximum uniform speed; and that there was then a resistance, exclusive of the friction of the working parts of the engine, of 22 lbs. or 23 lbs. per ton. The experiments made by Mr. Gooch, and which were conducted under the eye of Capt. Simmons, the Government inspector, would seem to establish facts contrary to this assumption. They were made by the indicator carriage, constructed by Mr. Gooch, and four passenger carriages, weighing together 50 tons. The incline is on an embankment, running into a wide valley, much exposed to the wind; and a strong side breeze blew during the experiments, which proved that a speed of 52·3 miles was obtained per hour, and could usually be obtained, even in such unfavorable weather. How far the conclusions arrived at by these experiments—that the resistance of the atmosphere, on broad-gauge carriages, is not more than 14 lbs. per ton—we shall not pretend to inquire; certain is it, that this low resistance differs very materially from every calculation previously made, and that too by sound practical men, such as Stephenson, Locke, Bidder, Scott, Russell, Wyndham, Harding, and a host of others, who have all been convinced that the resistance is equal to 22 lbs. or 23 lbs. per ton, and against whose opinions we have only that of Mr. Gooch, in support of his theory. These continual experiments on the Great Western Railway, almost daily puffed off in the *Morning Herald*, should be received with caution, as evidently done with a motive; and that motive is to endeavor to lead the public into the belief, that high velocities are not more expensive to railway companies than moderate ones—an idea contrary to all preconceived notions, and well-established mechanical fact; and also, that a broad-gauge is alone capable of securing those high velocities with safety to the public.

Ibid. No. 666.

An Improved Water-Level. By P. M. N. Benoit, Civil Engineer.

Translated for the Journal of the Franklin Institute.

Fig. 1, Plate II, represents the level ready for use, and fig. 2, on a scale three times as great, a vertical section of one of the glass tubes,

A, which are placed at each end of the horizontal tube, B. My improvement consists in a little frustrum of a hollow cone, *a b c*, open at each extremity, *a*, and *b c*, fixed in one of the vertical tubes, *f*, of the ordinary water-level, so that the larger base *b c*, of the cone, exactly fits the interior well of this tube; the upper end has an opening of not more than 2 or 3 millimetres in diameter. (·08 or ·09 in.)

It will be easily seen that this opening plays the part of a pierced diaphragm, opposing the rapid passage of the water from one hand to the other, nor can any air collect under the cone while the instrument is being filled with water.

The instrument may be constructed either by soldering such a frustrum of a cone made of thin metal, to the sides of the tube, just below the junction of the glass into the metal, or by sliding it into its place and securing it by packing—or by using a common glass phial whose bottom has the usual conical form—piercing the top of this cone with a small hole, and grinding the outside of the bottom so as to fit the horizontal tube.

The advantages of this instrument are, that while it does not cost any more than the common level, and does not differ from it in appearance or in the mode of using it, it may be carried from one station to another, without dismounting it, and without losing a drop of water, and may be consequently used much longer than the common level, without refilling. Bull. Soc. Enc. Nat. Ind., Jan., 1848.

AMERICAN PATENTS

List of American Patents which issued in the month of July, 1847, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Boxes for Railroad Car Axles;* James Tull and S. Norris, Philadelphia, Pennsylvania, July 3.

Claim.—"What we claim as new, and desire to secure by letters patent, is the forming the journal boxes cylindrical on their upper, or on their upper and lower sides, and of combining them with the plummer blocks, so as to allow them and the axles of the respective pairs of wheels, when applied to railroad carriages, to conform themselves freely to the inequalities of the height of the rails on the opposite sides of the track; the whole combination and arrangement being substantially the same with that made known."

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2. For an *Improvement in Springs for Artificial Teeth;* George Stuart, Philadelphia, Pennsylvania, July 3.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of forming the spring joint and arms of said instrument, in the manner set forth: that is to say, by the coiling of the middle of the wire, so as to constitute the spring joint, and the extending

of the outer ends thereof, so as, in part, to constitute the elastic arms of the lever, in combination with the cheek plate, operating in the manner and for the purposes set forth, and in combination, also, with the sets of artificial teeth; the whole arrangement of the respective parts being the same substantially with that herein fully made known. And this I claim, whether the respective parts be made in the precise form herein described, or in any other that is the same in its action and results, and attaining the end by means substantially the same."

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3. For an *Improvement in the Injecting Ventilator;* Frederick Emerson, Boston, Suffolk county, Massachusetts, July 3.

The object of the injecting ventilator is the introduction of atmospheric air into the interior of ships and buildings, and into any other places where a continuous supply of pure air is required.

Claim.—"I claim as my invention, and desire to secure letters patent for the combination of the inverted cone partitions, and hollow frustrum or frustrums and tube, as specified, for directing a current of air into the place to be ventilated."

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4. For an *Improvement in the Ejecting Ventilator;* Frederick Emerson, Boston, Suffolk county, Massachusetts, July 3.

Claim.—"I do not claim, simply, the combination of the conic frustrum with a fender above it; but what I do claim as my invention, and desire to secure by letters patent, is so placing the fender above the conic frustrum, as to leave a clear space between the plane of the upper edge of the conic frustrum, and the parallel plane of the lower part of the fender, substantially in the manner and for the purpose specified, whether the fender be a flat disk, or varied from that form, as described."

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5. For an *Improvement in Water Wheels;* J. B. Conger, Jackson, Madison county, Tennessee, July 10.

The patentee says,—"The nature of my invention consists in so forming and arranging the buckets, or vanes of the wheel and shutes, that the water, on entering through the shutes, into a space between them and the wheel, is given a direction and velocity similar to that of the wheel, and a contrary direction, on leaving it, with equal velocity, as relates to the wheel, but without actual velocity; thereby causing the wheel to stop the motion of the water entirely, at the same time that it (the wheel) has a velocity of rotation equal 0·7—that of the water, if allowed to escape freely, being 1."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing a wheel and shutes, having buckets or vanes with the top part cycloidal, and the bottom part plain, placed between two concentric rings, using one-half of the cycloid, or nearly so, commencing at or near the curf for the top of the bucket, and making the plain part a tangent to the vertex, as herein described and set forth."

6. For an *Improvement in Steam Engines;* Benjamin S. Benson, Baltimore, Maryland, July 10.

The nature of this invention consists in placing one, two, or more cylinders around the axis of a shaft, parallel with, and at equal distances from it, and connecting the rods of the pistons that work in them, with arms projecting from a shaft, placed at an angle less than a right angle with the axis of the shaft that carries the cylinders, and thus obtain a rotary from the reciprocating motions of the pistons, when the pistons are actuated by steam, &c., or give reciprocating rectilinear motions to the pistons, when the shaft or shafts are rotated by any power, to cause the pistons to act on any fluid as a pump.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing a cylinder or cylinders at a distance from the axis of their motion, substantially as described, when this is combined with the connecting of the piston or pistons with the arm or arms, (or their equivalent,) of a shaft, or its equivalent, the axis of motion of which makes an angle less than a right angle, with the line of the axis of motion of the cylinder or cylinders, substantially as herein described."

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7. For an *Improvement in Ships' Blocks;* William W. Hill, Greenport, Suffolk county, New York, July 10.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming the cheeks of the block circular, with rebates to receive the flanches of a metal head-piece or cap, constructed with flanches to fit the rebates, and with a concave segmental groove, whose highest part, inside, shall be above, or in line with, the top of the wood shell, thereby making a circular shell receive a larger sheave, than the ordinary eliptical shell of the same length can usually do; and I claim the combination therewith of metal straps, passing through the metal head-piece, and into mortises in the cheeks of the shell, instead of into grooves on the inner faces of the cheeks, the straps having holes to receive the pin of the sheave, and such mode of forming, construction, and combination, being substantially as described."

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8. For an *Improvement in Moulding Brick;* Stephen Ustick, Philadelphia, Pennsylvania, July 10.

This invention consists of an apparatus for moulding dry clay, which is pulverized and sifted for that purpose.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the combination of the pistons with the cams in the manner described, said cams being adjustable, and guiding the pistons during the whole revolution of the wheel, substantially as set forth. Secondly, I claim the combination of the revolving screen and pulverizer with the horizontal wheel of moulds, constructed substantially as described. And lastly, I claim, in combination with the double piston moulds, the apparatus for discharging the brick from the mould, and cleaning the face of the pistons, consisting of the vertical piston and cam, arranged as described."

9. For an *Improvement in Printing Presses;* R. M. Hoe, City of New York, July 10.

"The nature of my invention," says the patentee, "consists, in the first part, in operating the sliding frame, that carries the inking rollers over the form of types, by a motion independent of that which operates the frame that carries the frisket and finger bars, so that by a simple change of the cam that gives the motions to the inking rollers, they can be passed over the form of types once or twice for each impression, thereby admitting of a greater number of impressions than can be given when the rollers move with the frisket.

"The second part of my invention consists in so arranging the delivering rollers and tapes, relatively to the location and motion of the frisket, that part of it (the frisket) shall pass between the rollers and tapes, that they may remove the sheet therefrom, and deliver it to the fly frame or other apparatus.

"The third part of my invention relates to the mode of arranging and operating the fingers to grasp the sheet.

"The fourth part of my invention relates to the combination and arrangement of parts for giving the requisite reciprocating intermittent motions to the frame that carries the rollers for inking the form of types.

"And the fifth part of my invention consists in combining with the frisket frame, an arrangement of parts for giving to the frisket the requisite reciprocating intermittent motions."

Claim.—" What I claim as my invention, and desire to secure by letters patent, is, first, giving the inking roller frame, for inking the form of types, its motions independent of the motions of the frisket frame, substantially as described, whereby the range of motion to be given to them can be reduced, more time can be given to the rollers to receive their supply of ink, and the rollers can be carried over the form of types once, twice, or more times, for each impression, as described.

"Secondly, I claim the method of removing the printed sheet from the frisket, by passing a part of the frisket between rollers that remove the sheet, and deliver it to the fly frame or other apparatus for delivering the printed sheets, substantially as described.

"Third. I claim the arrangement of the finger bars, in combination with the inclined planes into which the ends of the forward bar passes, and the lever which acts as an inclined plane to open the fingers, and then rises to suffer the tension of the spring to close them substantially as described.

"Fourth. I claim the arrangement of either of the cams that operate the inking roller frame, the cogged sector, and the train of wheels, in combination with the inking roller frame, substantially as described, whereby I am enabled to attain the required intermittent reciprocating motions more efficiently than by any other means known to me; and

"Fifth. I claim the arrangement of the cam, the sector, and train of wheels, as described, in combination with the frisket and finger frame, in the manner and for the purpose substantially as described."

10. For an *Improvement in Reaping Machines;* William F. Ketchum, Buffalo, Erie county, New York, July 10.

The patentee says,—" The nature of my invention consists in an endless chain cutter, for cutting grain and grass, and the application of it in such a way as will cause it to run around pulleys, with the back of the cutter against them—(the pulleys are fixed on the rack piece of proper length for the width of the swath to be cut)—with the cutter passing round the pulleys, the cutter being covered all but the edge, which comes in contact with the grain or grass."

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the endless chain cutter, in combination with the pulleys and rack teeth, for cutting grain and grass as described. I also claim the crooked arm or coupling piece, in connexion and combination with the rack piece and frame as above set forth, for the purposes stated."

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11. For an *Improvement in the Rotary Engine;* Philo C. Curtis, Utica, Oneida county, New York, July 10.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the constructing a rotary engine of one, two, or more cylinders, crossing and being united to each other at their centres, as also to a solid and hollow axle on which they are suspended, and revolve, by means of heavy pistons placed within the cylinders, and shifted from end to end by steam admitted to the same, through the lower compartment of the tube, and escaping through the upper compartment of the same, through the medium of the side pipes, connecting the ends of the cylinders with the hollow axle, and alternately becoming steam and escape pipes, substantially in the manner set forth."

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12. For an *Improvement in Gearing for Connecting Feed or Pressure Rollers of Planing Machines;* W. E. Cornell and Charles W. Brown, Boston, Suffolk county, Massachusetts, July 17.

Claim.—" What we claim as our invention, and desire to secure by letters patent, is the method of communicating rotary motion, in the reverse direction, from one roller, arbor, or shaft, to another, by means of two auxiliary wheels, whose axes are independent of the frame, so connected with each other, and with the wheels on the axles of the rollers, &c., by jointed links, as to admit of varying the distance between the two rollers, arbor, or shafts, at pleasure, substantially as described. And, in combination with this, we also claim the diagonal link or links, for retaining the auxiliary wheels in their proper position, relatively to the wheels on the axles of the rollers."

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13. For an *Improvement in Changing Gear;* W. M. Davis, Gardiner, Kennebec county, Maine, July 17.

Claim.—" I do not claim engaging and disengaging the shaft and cog wheels by a sliding connecting plate, but I merely claim the mode of

changing the speed of the shaft carrying the article to be wrought, during the operation of the machinery, by means of the combination of the pinions with the shaft, sliding connecting plate, rod, collar, and lever, arranged and operated in the manner before described."

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14. For an *Improvement in Ventilating the Timbers of Vessels;* Ebenezer Knight, Brooklyn, Kings county, New York, July 17.

The nature of this invention consists in making use of the bilge water in vessels, to ventilate the spaces between the timbers and the planking, and the ceiling of vessels, for the purpose of preventing the generation of noxious gases, and preserving the timber, by leaving a free admission for the passage of air through the plankshire, or near thereto, and the salt stops and other obstructions, the motion of the vessel causing the bilge water to flow from side to side, alternately exhausting and forcing out the air, and thus keeping up a free and constant circulation of pure air, the presence of which tends not only to preserve the timber of the ship, but promotes the health of the crew, and adds much to the comfort of ships.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the motion of the bilge water in vessels, induced by the motion of the vessel, in combination with the air passages operating to the atmosphere, and the openings in the salt stops, when such are used, for the purpose of ventilating the spaces between the timbers of vessels, for the purpose and substantially in the manner described."

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15. For an *Improvement in Couplings for Railway Cars;* William C. Bussey, Rockgrove, Stephenson county, Illinois, July 17.

The patentee says,—"The nature of this invention and improvement consists in combining and arranging within a suitable cast iron box, (having an open flaring mouth,) an eccentric notched tumbler, a roller, and a dog, turning on round pins inserted into the front and back plates of the box, and a spring or weight, for holding the dog in gear with the tumbler, arranged and operating in such manner that, when a car to which the coupling bar is attached, approaches a car to which the box is affixed, the head of the coupling bar enters the mouth of the box, passes between the roller and tumbler, strikes the tail of the tumbler, causes it to turn on its axis, and brings a convex protuberance thereon into the concavity of the coupling bar, forming its neck, and, at the same time, the dog into the notch of the tumbler, by the action of the spring, or by a weight, by which the coupling is effected—the said dog having an extended tail affixed to it, reaching through a mortice in the edge of the box, for the purpose of striking against the appended car, when the car to which the box is affixed may be suddenly thrown or turned from its track, by which the dog becomes disengaged from the tumbler, and the cars detached by the turning of the tumbler on its axis, which allows the head of the coupling bar to pass freely from the box between the roller and tumbler;

by which arrangement and operation the apparatus becomes self-acting, there being provision made for a similar box and coupling apparatus on the appended car, having the tail end of the dog extending through the box on the opposite side, so that should the cars turn off the track on that side, the separation may take place in a similar manner to that described;—the box and all the parts contained in it being cast of iron or other suitable material, except the spring, which is made of good cast steel—the two boxes and their contained coupling and uncoupling apparatus for each coupling bar being made in a similar manner, and the coupling bars being made alike at both ends, namely, each end having a head and neck formed thereon, for the purpose of connecting two adjacent cars, said coupling bars being made entirely of wood or iron, or of both combined."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is coupling and uncoupling cars by means of an eccentric tumbler, revolving roller, turning dog and coupling bar, constructed and arranged, and operated substantially in the manner and purpose above set forth, the coupling being effected by the motion of the car."

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16. For an *Improvement in Cultivators;* Alanson T. Odell, Royalton, Niagara county, New York, July 17.

The patentee says,—"The nature of my invention and improvement consists in a certain combination of two double-jointed, hinged, and wheeled wing frames, containing side cultivators, with a central frame attached to the rear end of the tongue, containing a third wheel upon which it is supported, and a central cultivator, so constructed, arranged, and operated, that undulatory land may be cultivated effectually in uniform depths of furrows, without straining or breaking the frames, the cultivators being made to accommodate themselves to the hills and hollows, and other inequalities of the land, by means of flexible central joints or hinges attached to the frame of the central cultivator."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the combination of the two double-jointed, hinged, and wheeled wing frames, containing the side cultivators, with the central frame containing the third wheel, and central cultivator, constructed, arranged, and operated, in such manner, that undulatory land may be cultivated in uniform depths of furrows, without straining or breaking the frames, the cultivators being made to accomodate themselves to the hills and hollows, and other inequalities of the land, by means of the flexible central joints or hinges, attached to the aforesaid central frame.

"2d. I also claim combining a third wheel with the two side wheels, in a jointed, flexible, or folding cultivator frame, made in the manner above described."

17. For an *Improvement in the Process and Apparatus for the Treatment of India Rubber Fabrics;* C. J. Gilbert and Gamaliel Gay, City of New York, July 17.

The patentees say,—"The first part of our invention, which relates to the extracting of the sap, consists in subjecting the raw india rubber or caoutchouc to the action of dry heat, and of steam, of 200 degrees of Fahrenheit's scale, (more or less,) until the foreign matter called 'sap' is thoroughly extracted therefrom.

"The second part of our invention, which relates to the method of heating, curing, or drying india rubber fabrics, consists in subjecting them, when finished, to the combined action of heat and steam.

"The third part of our invention, which relates to the application of sulphur in the process of curing, consists in subjecting the india rubber, or the fabrics thereof, to the fumes of sulphur, or to sulphurous acid gas, either before or when exposed to the heat in the curing process, whether this (the curing process) be effected by heated air or steam, or by both.

"The fourth part relates to the method of removing, from the surface of india rubber fabrics, the peculiar clammy feeling which it possesses after the process of heating, curing, or drying, and consists in exposing the surface of such fabrics to a rapid current of air, which, in a short space of time, removes entirely the clammy feeling so well known to those acquainted with this branch of manufactures.

"And the fifth part of our invention relates to the apparatus for the application of the various parts of our processes, and consists in placing the cylinder which receives the fabrics in a vertical position, that the fabrics may hang loosely from a series of loops; also in heating the cylinder and fabrics within it, to above the boiling point; in combining with the vessel that receives the fabrics, a tube provided with a blower, for the purpose of carrying a rapid current of air through the vessel, and made to connect with both ends of the vessel, and provided with a branch tube or inverted funnel, through which the fumes of sulphur, &c., can be introduced. And finally, in combining the vessel that contains the fabrics with a steam boiler, by means of a pipe, that steam may be made to circulate through the vessel."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is, first, the method of seasoning raw india rubber or caoutchouc, or extracting therefrom what is called the 'sap,' by subjecting it to the action of dry or moist artificial heat, separately or together, whereby we are enabled thoroughly to season raw india rubber, and so extract the sap therefrom, in a much shorter time than by exposing to the action of the atmosphere, as described.

"Secondly. We claim the method of heating, curing, or drying india rubber fabrics, made of any compound of which rubber is the basis, by subjecting them to the combined action of dry heat and steam, substantially as described, whereby the steam is prevented from condensing on the surface of the fabrics, and injuring the surface and lustre thereof, and whereby a more perfect surface is produced than when subjected to either dry heat or steam, separately as described.

"Third. We claim submitting india rubber fabrics to the action of the fumes of sulphur, or sulphurous acid gas, preparatory to the curing or drying process, substantially as described, instead of incorporating the sulphur with the rubber, or spreading it on the surface, as described.

"Fourth. We claim passing a current of air over the surface of india rubber fabrics, for the purpose of removing the peculiar clammy feeling left on the surface of these fabrics after the drying process, and which has heretofore been effected by exposure to the solar rays, as described.

"Fifth. We claim the vertical cylinder in which the above processes are carried on, in combination with the movable frame to which the fabrics are suspended, substantially as described.

"Sixth. We claim the method of heating the cylinder which contains the fabric substantially as described, in combination with the method of introducing steam therein, as described

"Seventh. We claim, in combination with the vessel that receives the fabrics, the tube for the circulation of air, the two ends of which connect with the said vessel, when the said tube is provided with a blower or other apparatus for inducing the current of air through it, and made to pass through a heating apparatus, as described.

"And finally, we claim, in combination with the cylinder and tube, as described, the means of introducing gases or fumes in the said tube, to be conducted to the fabrics in the cylinder, as described."

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18. For an *Improvement in Paring Apples;* J. Bullock, Jr., and Sewall Benson, City of New York, July 24.

Claim.—"What we claim as new, and desire to secure by letters patent, is the following:—

"First. The arrangement of the spring shaft knife, for paring apples upon a drum wheel. Second, The combination of said drum wheel, (with the knife attached,) with the driving wheel, regulated in its operation by the pulley, band, and lever, and brought back to its place of starting by means of the spring and cord, and the whole so arranged as to make the entire operation by one revolution of the driving wheel, as herein set forth."

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19. For an *Improvement in Composition for Fire Brick;* David Cannon and Heman S. Lucas, Chester, Hampden county, Massachusetts, July 24.

The patentees say,—"The nature of our invention consists in compounding soap-stone, clay, and borax, so as to retain and radiate heat, affording protection when applied as a lining to surfaces exposed to great heat."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the compounding of soap-stone, clay, and borax, in proportions as described, or in similar proportions to produce the like result."

20. For an *Improvement in Rotary Printing Presses;* Richard M. Hoe, City of New York, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, putting the form or forms of type on a movable or permanent segment of a cylinder, which forms the bed and chase, substantially as described, when this is combined with a cylindrical distributing table which occupies another segment of the same cylinder, substantially as described.

"Second, I claim giving to the inking rollers, a movement towards and from the centre of the cylinder that carries the form of types, substantially as described, when this is combined with the form of types and the distributing table, made on one and the same cylinder and of different radius, as described, whereby the inking rollers are adapted to the different diameters of the form of types and distributing table, as described.

"Third, I claim giving to the doctor or fountain roller of the inking apparatus, a slow continuous rotary motion in combination with the ratchet connexion between the roller and the mechanism from which it receives its continuous rotary motion, substantially as described, whereby the ink is more regularly supplied and by which also this supply may be altered when desired, as described, and lastly, I claim the method of securing the form of types on a cylindrical surface with column rules made thicker towards their outer than their inner edge, by connecting these with grooves in the bed by which they are permitted to approach and recede from each other, and at the same time kept down to the same radius, substantially as described, whereby prismatic types can be secured and held on a cylindrical surface as effectually as on a flat surface, as described."

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21. For an *Improvement in the method of giving the Reciprocating Rectilinear Motion to the Bed of the Napier Printing Press;* Richard M. Hoe, City of New York, July 24.

The patentee says,—"The first part of my invention relates to an improved method of giving the rectilinear reciprocating motion required for moving the bed in and out, as an improvement on the 'mangle-wheel movement.'

"The second part of my invention relates to the mode of raising and lowering the cylinder that gives the impression."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of ending and commencing the alternating motions of rectilinear reciprocating movements, and insuring the proper relative positions of the cogs of the racks and wheel when the wheel begins to act on them, by means of the two racks and cog wheel, in combination with the vibrating lever, substantially as described.

"I also claim the method of elevating and depressing the pressing cylinder, by means of the threaded sliding rods that carry the pressing cylinder, in combination with the cogged nuts and sliding bar with a rack at each end, and so arranged that the racks and cogged

pinions can be thrown out of gear, for the adjustment of the cylinder, for the purpose and in the manner, substantially as described."

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22. For an *Improvement in Reacting Water Wheels;* Emanuel Parker, Camden, South Carolina, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining a wheel, having buckets, made in the particular manner described, with a circular tapered water way, or flue, made in the particular manner described, inclining towards the periphery of the wheel, for the purpose of introducing the water to the buckets, at the required angle and quantity, and preventing the main body of the water resting upon the wheel, the core being formed like the frustrum of a cone, and the inner side of the rim sloped or inclined outwardly, at the same angle as the sloped side of the cone, the periphery of said rim being vertical, and the top horizontal, and the buckets between them, the sections of a screw, whose upper ends are made to incline inwards on radial lines toward the core, at an angle of about 10 degrees—the water-way or flue, forming a segment of a circle gradually lessening in depth, from the place of entrance to where the end of the circle nearly intersects the place of beginning, the said flue inclining outward from a perpendicular line, about 20 degrees, so as to pitch the water against the buckets, at that angle, as above described and set forth, causing every bucket of the circle to be acted on simultaneously, the water escaping therefrom in a contrary direction to that at which the water enters, by which the pressure upon the pivot, which causes its rapid destruction is removed, by which the mill is rendered more durable, as herein set forth."

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23. For an *Improvement in Metallic Frames for Piano Fortes;* Timothy Gilbert, Boston, Suffolk county, Massachusetts, July 24.

"My improvement," says the patentee, "consists in applying to said frame and longitudinal bars, transverse or cross bars, which I cast in connexion with the long bars and main part of the frame. I apply beneath the frame, and transversely near the head of it, a deep cross bar which I also cast to the frame, and to the longitudinal bars."

Claim.—"What I claim, is the combination of the cross bars with the longitudinal bars, and straight and curved sides of the main frame, in the manner as described, whereby the said cross bars, serve as supports to the same, in order to prevent their springing out of place laterally, as specified, thus making the frame itself do all the work of supporting the strains of the strings and avoiding the employment of the usual bolts, and wooden frame work (other than the case or frame of the instrument) to which the iron frame is usually confined, the cross bar beneath the frame serving the purpose of an important support to the head of the frame, and also to the sounding board, the end of which is to be attached directly or indirectly to it."

24. For an *Improvement in the Centrifugal Pump;* A. W. and J. H. Von Schmidt, Washington City, District of Columbia, July 24.

"The nature of our invention," say the patentees, "consists, 1st, in the shape and arrangement of the case; 2d, in throwing the water in a tangent line; 3d, the manner of letting the water into the casing (or wheel) between the centre and periphery of said wheel; 4th, the arrangement of the syphon pipe at the end of the discharge pipe, and 5th, the arrangement of the valves, &c."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is taking the water in between the centre of the wheel and the periphery near to the tangential discharge pipe, as described. And this we claim in combination with the descending discharge pipe, in the manner and for the purpose described."

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25. For an *Improvement in Artificial Incubation;* James Cantelo, Citizen of the United States, residing in England, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is so constructing apparatus for hatching eggs, that the heat given to them may be contact heat from above, whilst the lower surfaces of the eggs are kept comparatively at a lower temperature.

"And secondly, I claim the arranging flexible pipes for imparting warmth to the young birds, as herein described."

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26. For an *Improvement in Condensed Air Engines;* Arthur Parsey, Middlesex county, England, July 31.

These improvements in obtaining motive power consists in certain modifications of machinery by means of which compressed air may be employed to work, without a vacuum, pistons, valves, levers, rods, and other appendages, for the purpose of producing mechanical force, and communicating that force as a motive power for driving other machinery."

Claim.—'I claim as my invention the chamber provided with the spring valve or piston, to regulate the elastic force of the air as it passes from the receiver to the cylinder in combination with the induction passage or passages, as described."

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27. For an *Improvement in making Bottles, &c., from Clay;* E. H. and C. J. Merrill, Akron, Summit county, Ohio, July 31.

The patentees say,—"The nature of our invention consists in forming the clay in a mould, by means of a revolving piston on which are spiral channels to draw the clay back as the piston enters the mould, and in such articles as bottles, &c., the inserting the bottoms after the other parts have been made."

Claim.—"What we claim as new and desire to secure by letters patent, is the employment of a core or mandrel after the form of the interior of the article to be made, and having spiral channels cut in its surface, substantially in the manner and for the purpose described.

"We also claim, in forming bottles or other similar articles of clay, the adding the bottoms thereof after the other parts have been formed. And we also claim an interior mandril having a radial arm jointed thereto, as described, for forming the bottoms of bottles and other similar articles, and in combination therewith, the exterior disk, all arranged and constructed substantially as made known, not confining ourselves to the precise modifications herein described, but suiting our arrangements to the articles to be manufactured."

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28. For an *Improvement in Machines for Cutting and Grinding Corn Stalks;* Ezekial Potts, Tredyffin Township, Chester county, Pennsylvania, July 31.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the knives with the crushing cylinder and cutting box, in the manner described."

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29. For an *Improvement in Cutting Chair and Sofa Backs;* John H. Belter, City of New York, July 31.

The following is extracted from the specification:—

For the better understanding of the description, it is necessary to state that the backs, intended to be cut by the machine, are made separately from the rest of the chair or sofa, and are not attached to the other part until they have been cut into open work.

Claim.—"What I claim is the apparatus for guiding and steadying the saw while giving it any required angle to follow the pattern to be cut, in combination with the adjustable platform and model support, the whole being constructed and arranged substantially as herein described."

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30. For an *Improvement in Tuyers;* L. C. Minor, Saugerties, Ulster county, New York, July 31.

"The nature of my invention," says the patentee, "consists in providing a sunk bottom to the tuyer to receive the dirt, an elevated bridge with cups and points, permitting the whole air chamber to be filled with air and passing out equally on all sides at the same time."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining the dishing stop plate with the plate and bridge, by means of the joints, foot, and cups, substantially as described."

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31. For an *Improvement in the manufacture of Gas;* Benjamin F. Coston, Washington City, District of Columbia, July 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the retort, with the vertical branch containing the material for presenting heated surface to the rosin and tar or other substance to be gasified as it descends from the reservoir, as described, whereby the required surface is obtained to insure the

production of gas with economy, and by which also the substance or substances from which the gases are to be produced is compelled to pass over and around the heated surfaces, as described.

"Second, I claim placing the reservoir or vase of crude material above the vertical branch of the retort, and combined with the stove or furnace as described, and connecting the retort and vase by means of a pipe which opens from one into the other as described, by means of which arrangement the weight of the column of rosin and tar in the reservoir aids in forcing down the crude material into the vertical branch of the retort to prevent choking, at the same time employing the heat of the furnace which surrounds the retort to keep the rosin, &c., in the reservoir in a liquid state, as described.

"Third, I claim combining the neck of the retort with the cooler, by extending this vessel (the cooler) entirely around the neck of the retort, and keep its temperature down to the boiling point or below, and thus prevent the tar, &c., from baking in the neck of the retort, as described.

"Fourth, I claim the method of regulating the supply of crude material to the retort by the consumption of gas by combining the hood of the gasometer with the cock or valve of the supply pipe through which the crude material passes to the retort, in the manner substantially as described, whereby the cock or valve is opened by the descent, and closed by the rising of the hood, as described.

"And lastly, I claim the method of condensing and washing the impurities from the gas, by combining with the gas pipe a condenser provided with a sieve for the spray of water and the bent up pipe for the discharge of the condensing water and impurities, without permitting the escape of the gas, as described."

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32. For an *Improvement in Bee Hives;* Oliver Reynolds, Webster, Monroe county, New York, July 31.

"The nature of my invention," the patentee states, "consists in combining with the hive an illuminated chamber, for alluring the bee-moths into it, where they are destroyed.

"Also in constructing the lower hives, each with one side inclined inwards, forming triangular spaces between every pair of hives for the insertion of triangular moth traps. Likewise in constructing the outer case with inclined channels leading from the entrance to the triangular moth traps.

"Also in forming spaces behind and between the vertical parts of the lighting boards communicating with the inclined channels to admit the bee-moth to enter said channels.

"Likewise in forming spaces around the tubes at which the bees enter, to admit the moths to the inclined channels leading to the traps."

Claim.—"What I claim as my invention and improvement, and which I desire to secure by letters patent, is, first, the making the case with the spaces around the entrance tubes combined with the inclined ways leading to the triangular traps, in the manner and for the purpose set forth.

"Second, I claim forming the entrances behind the lighting boards, in the manner and for the purpose set forth; that is to say, by suspending the lighting boards to the front of the case by the screws, which are turned to the right or to the left, for increasing or diminishing said spaces.

"Third, I claim narrowing each hive on one side thereof where it unites with the adjoining hive, so as to form triangular spaces for the reception of the triangular traps, as above described.

"Fourth, I claim forming the moth traps with a horizontal tube, communicating with the interior of the traps and with the inclined channels in the case, arranged and operating in the manner set forth, by which the moths are conducted into the traps, and prevented from escaping therefrom.

"Fifth, I claim the method of separating the drones from the working bees, as above described."

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33. For an *Improvement in Inking Apparatus for Printing Presses;* Richard M. Hoe, City of New York, July 31.

The patentee says,—"The object of this invention is to provide hand presses with an inking apparatus operated by power to insure the proper inking of the form of types, and to save the hard labor heretofore employed for this purpose. The inking apparatus is placed by the side of the bed frame of the press, so that when the bed and the form of types on it is carried out from under the platen, it will be so situated that the inking rollers shall pass from the distributing rollers over it, and back again one or more times, as may be desired. And the nature of my invention consists in giving the requisite reciprocating motion to the carriage of inking rollers, by means of an arm on a vibrating shaft, or arber, connected with the roller carriage by a jointed forked link or bale, the shaft of the lever being provided with a crank arm connected by a joint link with a rotating crank of less length on a shaft below, which receives its motion from another and parallel shaft by two cog wheels that may be shifted to vary the relative motions of the two shafts when it is desired that the inking rollers shall pass a greater number of times over the form of types for each impression, according to the quantity of work desired to be produced, the latter of these shafts being actuated by a worm that rotates continuously by its connexion with the main or driving shaft of the mechanism, and which, to intermit the motions, can be thrown in and out of gear, by having one end of its shaft working in a swivel box, and the other in a sliding box, so that by means of a catch link, it can be thrown into gear when the form of types is carried out to be inked, and thrown out by a cam at the end of the inking operation. And my invention consists also in providing the shaft of the worm wheel with a cam to vibrate a lever provided with a hand catch, to turn the doctor roller the required distance at each operation, to carry up the requisite quantity of ink, and another cam, which by means of a jointed link and lever, depresses the taking roller to receive its supply

of ink from the doctor roller, and then carries it up to transfer its supply of ink to the distributing roller."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mechanism for communicating motion to the carriage of inking rollers, or the mechanical equivalents therefor, in combination with the catch link and lifting shaft, by means of which the parts are thrown in and out of gear, to operate and stop the inking rollers, substantially as described.

"I claim transferring the motions from the shaft of the worm wheel to the rocking shaft, the arm of which is in connexion with the carriage of the inking roller, by an intermediate shaft, the motion being transmitted from one to the other by two spur wheels which may be changed to carry the inking rollers over the form of types a greater or less number of times for each impression, substantially as described."

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34. For an *Improvement in Boiler Furnaces;* Jacob Seaburg, City of New York, July 31.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming of an opening or openings near to the lower part of the ascending flue, in the chimney stack, in combination with the descending flue, substantially as described, to check the draught of the chimney, and thereby to detain the heated gases under pressure within a furnace, in the manner set forth."

List of American Patents which issued in the month of October, 1842, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Weaving Fish Nets;* Levi Van Horsen, New Haven, Connecticut, October 7.

The patentee says,—"The nature of my invention consists in weaving fish nets, having flat square knots, and diamond shaped meshes, by means of machinery."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the jaws, the gums, the teeth, and the hooks, for forming an open noose, constructed in the manner set forth.

"I also claim the combination of the sweeps and levers, for forming the meshes; and, in combination therewith, the casts and cams on the shaft, for moving them in regular succession.

"I further claim the combination of the lathe, and frame attached thereto, on which the levers and casts are hung, and suspending the lathe on levers so as to be raised by a treadle, constructed and arranged for the purpose herein described."

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2. For an *Improvement in Horse Powers;* Isaac R. Lawrence, Chatham, Columbia county, New York, October 7.

The patentee says,—"This improvement consists in forming a jointed

railway of parallel plates, twice the length of the links to which said plates are cast, said plates being cast on one half the links, or on every alternate link, and extended beyond the ends of the same half their length, so as to overlap the intermediate link, which is cast without parallel plates, so that as the chain passes around the polygonal drum, and the links are bent at the joints, the said projecting ends of the plates forming the railways, will pass the sides of the said intermediate links without obstruction, the ends of the slats of said intermediate links not extending beyond the outer face thereof, whilst the slats of the links having the parallel plates extend through said links, and between said plates."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the endless chain horse power with parallel plates, nearly twice the length of the links, on the sides of one-half of them, thereby producing one-half the number of joints in the railway that there are in the chain, thereby preventing a sagging at the joints, by means of the said plates extending from the periphery of one of the upper sustaining rollers to the periphery of the next succeeding roller, whilst the joint of the chain is passing from one to the other, and also producing a double railway, the inner series of plates producing a railway for traveling over the upper sustaining rollers, and the outer series of plates a railway for traveling over the lower sustaining rollers, for preventing the chains from sagging in revolving from one side of the machine to the other."

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3. For an *Improvement in Churns;* Daniel F. Hitt, Galena, Joe Daviess county, Illinois, October 7.

The patentee says,—"I prepare a hollow trunk, log, or cylinder, of such capacity as may be requisite for containing the quantity of cream intended to be churned, and this I suspend in a suitable frame, by means of gudgeons placed equidistant from the two ends of the above named vessel, which is to receive a rocking motion on the gudgeons. Under each end of said gudgeons I place a spring, which may be varied in form, and may be made either of wood or of metal. These springs are not to be in contact with the log or vessel that forms the body of the churn, when such vessel stands horizontally, but said body is to be brought into contact with them alternately, when it is made to rock."

Claim.—"Having thus fully described the manner in which I construct my churn, it is to be understood that I do not claim a rocking churn as of my invention, nor do I claim the suspending of the vessel which is to contain the cream, on gudgeons at its centre, the bodies of revolving churns having been so suspended, and the contents having been allowed to fall from end to end, by the rotary motion given to such body; but what I do claim as my invention, and desire to secure by letters patent, is the manner in which I have combined the respective springs with the body of a churn which is to receive a vibrating motion upon gudgeons, by so arranging them as that they shall alternately be acted upon by such vibrating motion, and shall, by their

conjoint re-action in this combination, tend to raise the depressed end of the churn, as herein set forth."

4. For an *Improvement in Pumps;* B. T. Babbit, Little Falls, Herkimer county, and S. C. Higbee and P. W. Plantz, Openheim, Fulton county, New York, October 7.

The patentees say,—"The nature of our invention consists in constructing two air vessels in connexion with the supply pipe, one on each side, or it may all be in one, as the case may require, for the purpose of giving elasticity to the re-action of water in the supply pipe, so as to not check the velocity of the water while the pump is operating on the dead centres, thereby giving ease to the supply pipe, as, when lead is used, it is subject to be broken or soon chafed off. Also causing the main cylinders to fill much faster than they otherwise could, thereby producing a steady stream from the pump, and a steady and uniform current through the supply pipe while the pump is operating."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of air chambers to the supply pipe of pumps or engines, together with the manner in which the pump is cast, as described."

5. For an *Improvement in Casting Spoons;* Luther Boardman, Chester, Middlesex county, Connecticut, October 7.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming of such moulds with a main descending gate leading down nearly to the lower end of the spoon, or other article to be cast, where it is to communicate with the proper cavity, by means of a lateral descending gate or sprue, in combination with the sprue above this, and towards the upper end of the cavity for receiving the metal, having an ascending direction; the whole being formed in the manner and for the purpose herein fully set forth.

"And I will here remark, although I have spoken of a single lateral ascending gate, or sprue, leading to each cavity, there may be two or more such lateral ascending gates, without producing any injury, although I do not think them necessary or desirable."

6. For an *Improvement in Straw Cutters;* Edmund Warren, City of New York, October 7.

The patentee says,—"The nature of this invention consists in twisting a two, three, or four-edged knife to a slightly spiral form or auger shape, or setting knives (edges out) spirally round a rod or shaft and these made to cut against a wooden roller or band. Its nature also consists in an arrangement by which the hopper can be turned down or up at any angle."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is,—

"Firstly, the revolving disk, for the purpose of changing the position of the hopper.

"Secondly, the combination of the belt, consisting of hide, leather, or other suitable material, and the two rollers with the cutting knives to form a good and durable surface for the knives to act upon.

"Thirdly, the application of the spiral knives, their backs set to a small round shaft, or, instead, one blade wound evenly round a shaft in a long spiral, and secured at each end with a ring and collar.

"Fourthly, I claim the application to straw cutters of the *spiral cutters,* made of one piece and with two, three, four, or more edges."

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7. For an *Improvement in Saw Mills;* Pierson Crosby, Fredonia, Chatauga county, New York, October 7.

The patentee says,—"The principal improvements desired to be patented, are in the manner of constructing the frame by which it is rendered more portable, less expensive, and more permanent, and in the apparatus for regulating the feeding and for throwing the said apparatus in and out of gear; likewise in the construction of the dogs, for securing the logs."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is arranging the fender, posts, and gate at an inclination, as described, in combination with the location of the crank shaft and pitman rods, the former being placed in front of the gate, and the latter being connected with the gate near the top thereof, so that the gate in working shall pass by the crank shaft instead of working entirely above it, and that part of the gate to which the pitman rods are attached, is in a vertical line, or nearly so, over the shaft, all as described."

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8. For an *Improvement in Combing Wool;* Charles G. Sargent, Lowell, Middlesex county, Massachusetts, October 7.

The patentee says,—"I would remark that I am aware that machines for combing wool have been constructed with cylinders and wheels having points or teeth projecting from their surfaces or peripheries, such teeth being generally inserted in the sides of the wheels and consequently standing *parallel* to each other. Therefore I do not intend to claim the use of such wheels or cylinders, but what I consider new and claim as my improvement, is, the *horizontal* cylinder, having its points or teeth arranged as above described, in combination with the vertical wheel of radial teeth; or, in other words, the combined arrangement of the teeth of the cylinders and wheel, as set forth.

"Also, the combination of the cylinders and wheel having their teeth arranged as set forth, the object of one cylinder being to aid in the removal of the wool from the other cylinder, and its deposit upon the wheel.

"Also the combination of the endless guiding band with the wheel of radial points, the same being arranged and operating as herein set forth."

9. For an *Improvement in Cutting Shingles;* Sylvester Munson, Dillon, Tazewell county, Illinois, October 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, the combination of the two gauges when united by a joint or joints, in the middle, and provided with the means of setting them, with the knife, so that by the shifting of the bolt from side to side, the shingles are cut tapering, as herein described."

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10. For an *Improvement in Augers for Boring Earth;* John M. Cooper, Newbern, Green county, Alabama, October 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the hollow tube and grooved cross piece with the boring apparatus so as to keep up a communication between the superincumbent air or water, in the shaft and the under side of the plate, all as herein described."

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11. For an *Improvement in Spark Extinguishers;* James Ecklor, Catskill, Greene county, New York, October 7.

The patentee says,—"The nature of my invention consists in attaching to and enveloping or surrounding the smoke-pipe or chimney with a sheet iron shell, or case with screens attached inside, also surrounding the pipe, and above it, and also the insertion of tubes or pipes into and around the chimney, through which the sparks necessarily rush and fall to the bottom of the shell or case, either immediately upon leaving the tubes, or after being forced through the screen."

Claim.—"What I claim as my invention, is the manner in which the pipes are placed in the chimney, giving direction to the sparks, *and in combination therewith,* attaching the screens to the outside shell, as set forth, so as to produce the effect of arresting the sparks, and causing them to be extinguished, and to fall to the bottom of the shell, or outside case, from which they can be readily removed; and I claim the right to use for such screens, either wire or perforated metal, and to vary the proportions, of any or all such improvements, as different cases may require, without variation of the principles of such improvements."

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12. For an *Improvement in Making Segars;* Jonathan Ball, Buffalo, Erie county, New York, October 13.

The patentee says,—"The nature of my invention consists in rendering the end of the segar impervious to the moisture of the mouth, thus entirely preventing the ill effects of the tobacco to the lips, and at the same time preventing the ill effects of the moisture of the mouth to the segar, without which it becomes saturated, and loathsome, preserving at the same time the draught or passage for the smoke perfectly free and open; the method I employ is to form a composition of gum shellac dissolved in alcohol or any other substance that will dry quick, and is impervious to water."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the solution to the segar which renders it impervious to water or the moisture of the mouth, while smoking."

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13. For an *Improvement in Furnace Stoves;* Stedman W. Hanks, Lowell, Middlesex county, Massachusetts, October 12.

The patentee says,—"When the wood and fire are introduced into the stove and the inner cylinder becomes heated, currents of air enter the holes in the bottom, and passing up between the two cylinders, become heated, and consequently expanded and forced out through the apertures in the top, the register there being open. The inner rim or register on the top being shut, and the cap on the tube and the cricket adjusted to its place, the hot air will pass down the flaring passages, and entering the hollow top of the cricket, come up through the holes in the sheet iron top, so as to afford warmth for the feet."

Claim.—"I claim as my invention the cricket above described, in combination with the stove above described, or with any stove of like construction and principle, by which the heated air is applied for the purpose of warming the feet."

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14. For an *Improvement in Lard Lamps;* Enoch W. Perry, Boston, Massachusetts, October 12.

The patentee says,—"In ordinary lamps for burning oil or concrete fatty matters, the wick tubes are supported in their position in the fountain, by means of a screw inserted in the aperture of the top of the fountain, the wick tubes passing through and being soldered into the screw. The screw is hollowed out so as to form a small cup around the tubes, *for the reception of any oil which may flow from the wick while burning.*

"One part of my invention consists in appending to this screw a deep cup which shall extend *below the screw* (and into the reservoir or lamp).

"The wick tube extends through the cup, its top terminating on or about the level with the top of the cup part of the screw, so that the part of the wick extending above the tube shall be in part or nearly all, within that part of the cup above the top of the tube."

Claim.—"What I claim is, forming the upper part of the wick tube as described, whether the same is used in a lamp for burning concrete matters, or animal, or vegetable oils—or is combined with a screw cup or screw plate for sustaining the same in position."

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15. For an *Improvement in Hydrants;* John L. Chapman, Baltimore, Maryland, October 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I employ the double crank shaft, with its two cranks, so that a weight upon one of the cranks shall

operate with great force in closing the way of the cock, the plug of which is moved by a short crank, connected thereto by a suitable rod; the whole being arranged, combined, and operating substantially in the manner herein set forth. I also claim the manner described of forming the waste water way by means of the holes drilled through the plug of the valve shaft, and through the delivery pipe."

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16. For an *Improvement in Manufacturing Sheet Iron;* James, John, and William Wood, Wilmington, Delaware, October 12.

Claim.—"What we claim as new, and desire to secure by letters patent, is the giving to rolled sheet-iron such a glazed surface by the process, or in the manner set forth: that is to say, by covering the surfaces of the plates, after they have been freed from oxide, with a coating of linseed oil, or with other oil, or fatty matter, or with resinous solutions, making the sheets so prepared into a pack, heating them to redness, and then rolling them in this state, for the purpose, and substantially in the manner above set forth."

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17. For an *Improvement in Bee Hives;* Zachariah R. Hench, Port Royal, Juniata county, Pennsylvania, October 12.

The patentee says,—"The principal improvements I have made in the hive, and for which I solicit letters patent, are in the peculiar construction and arrangement of two glazed side boxes attached to the hive for attracting and securing the bees during the operation of taking the honey, or for colonizing bees; and also for catching strange bees, that come to the hive to rob it, and also in the construction and arrangement of a swarming board for facilitating the increase of the stock of bees; and likewise in the addition of a sliding frame and window with a door and perforated slide stand for ventilating the hive during the operation of catching the strange bees or robbers. And also the addition of ventilators and fumigators to the side boxes for again driving the bees from said boxes into the bee house, said fumigators being also used as side ventilators for supplying air to the side boxes during the operation of smoking the bees from the hive into the side boxes—by means of a common bellows, acting on both side fumigators at the same time, by having a branched tube extending from a central pipe, into which the nozzle of the bellows is inserted to each fumigator."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the glazed side chambers, fumigators, and ventilators, and funnels, with the glazed stand, constructed, arranged, and used in the manner described."

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18. For an *Improvement in Cutting Sausage Meat, &c.;* John H. Potts, Fayette, Howard county, Missouri, October 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the rhomboidal knives, fixed on

the upper or outer edges of the wedge-shaped projections at the centre of the concave revolving disk for cutting the meat into small pieces as it enters the machine from the hopper, in combination with the several series of fixed triangular knives, arranged in the dove-tailed slides of the cheek for cutting the meat into finer particles, in the manner herein set forth."

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19. For an *Improvement in Raising Bread;* Abel Conant, Lowell, Middlesex county, Massachusetts, October 12.

The patentee says,—"The nature of my invention consists in using tartaric acid, cream of tartar, citric acid, alum, or any other known acid in a dry state, or any compounds of acids, or any compound of which acid, or acids, is a principal ingredient, in a dry state, and mixing the dry acid, or acids, or the dry compound in a dry state, with dry flour, and in dissolving saleratus or other alkali, in a sufficient quantity of pure water, *sweet* milk, or other liquid, to neutralize the acids in the flour and to make it into dough, and in raising the flour, acids, alkali, and liquids thus prepared, into good dough, and in thoroughly kneading the dough so made, and making it into small loaves or rolls, and baking *immediately*. Or if other pastry than bread, in cooking *immediately* in the usual way, after the dough has been prepared, substantially as above stated."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the *manner* of *using* as herein described, *dry acids* or compounds of *dry acids* thoroughly mixed with *dry flour* or meal, and a solution of alkali in water, sweet milk, or other liquid with which the flour or meal is to be made into dough, for the purpose of puffing up or raising the dough, so that when cooked it will make good light bread or other pastry, without destroying the sugar, or the flour, or meal."

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20. For an *Improvement in Machinery for Pressing Bonnets;* Richard Murdock, Baltimore, Maryland, October 12.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before-described improvements on my patented machinery for pressing bonnets, hats, &c.: that is to say—

"First, Combining the metallic frame of the box iron with the elevated counter balance and curved arm or stirrups, by joints, as herein described, or by other means substantially the same, so that the operator can give to the iron any direction required.

"Second, Suspending the weight to the box iron frame by means of the curved arm or stirrups, or other analogous device, thus increasing the pressure of the iron on the bonnet or other article to be pressed, as before described.

"Third, Making the bearings of the spindle and the groove for the wheel in a jointed and adjustable frame or seat, as described, by which the inclination of the spindle and hat placed thereon can be changed,

whether constructed precisely in the manner herein set forth or in any otherway substantially the same."

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21. For an *Improvement in Ploughs;* William C. Pagett, Greene county, Ohio, October 17.

The patentee says,—"The improvement is intended in the first place for the cultivation of young corn and small plants of every description—throwing *against* them the fine dirt turned up in running a furrow, and *throwing from* them all the clods and stone, and thereby preventing them from being covered up. In the second place it answers in all respects the purposes of the common shovel plough by removing the arm and guard."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the guard, and the combination therewith of the mould board, as the same are herein fully described together with their operation. The invention of the common shovel plough is of course disclaimed."

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22. For an *Improvement in Door Locks;* Albert Bingham, Boston, Massachusetts, October 17.

The patentee says,—"The nature of my invention consists in applying a check bolt to the knob on the inside of the door, in such a manner that the same will intercept the latch bolt, and thus operate as a fastening; the said check bolt being movable by a key, or otherwise."

Claim.—"What I claim as new, and desire to secure by letters patent, is the application of a check bolt, movable by a key, to the knob, in the manner and for the purpose set forth."

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23. For an *Improvement in Flattening and Tempering Window Glass;* John J. Adams, Winslow, Gloucester county, New Jersey, October 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the movable or revolving tempering platform with its appendages, (either separately or in combination with the revolving flattening platform,) and also the series of grates for laying the glass upon; all of which is constructed and operated as herein set forth."

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24. For an *Improvement in the Manner of Constructing, Propelling, and Turning Steam Ships;* Robert L. Stevens, City of New York, October 17.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the so forming of a vessel as that the after part of the hull shall terminate in one or two cones, in the manner set forth, the after part of such cone, where it equals one-third or one-half of the whole diameter of the propelling wheel, more or less, constituting the

central portion of a spiral propelling wheel, revolving with it and being sustained and driven by a shaft extended forward through the axis of the stationary part of the cone; the whole being constructed and operating substantially in the manner and for the purpose herein set forth.

"Secondly, I claim the turning of a vessel round, either side to, by the passing of a hollow tube through the hold of such vessel, towards either of her ends, in the manner set forth, and by causing a current of water to pass through said tube, in either direction, by means of a spiral propeller, made to revolve within said tube, as herein fully described."

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25. For an *Improvement in Shearing Cloth;* James Pitts, Smithfield, Providence county, Rhode Island, October 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a rest or bar, in combination with the shear of a cloth-shearing machine; whether the shear be rotary, vibratory, or operating in any other manner, as described."

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26. For an *Improvement in Vegetable Cutters, &c.;* Henry Hoover, assignee of Martin Stoner, Waynesboro, Franklin county, Pennsylvania, October 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the knives between the disks, in combination with these and the rollers as before described."

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27. For an *Improvement in Manufacturing Sheet Iron;* Simeon Guilford, Lebanon, Pennsylvania, October 22.

The patentee says,—"The nature of my invention and improvement consists in finishing sheet iron with a clean surface, similar to the Russia sheet iron."

Claim.—"What I claim as my invention and improvement, and wish to secure by letters patent, is the finishing of sheet or thin rolled iron free of scruff or oxide (with which the sheet iron finished by the old process is covered) by means of acid and friction for cleaning and burnishing the surface before the manufacture of the article is completed, together with the combined effect of the particular degree of heat used to complete the process, substantially as set forth."

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28. For an *Improvement in Propellers;* John Laing, Ellicott's Mills, Ann Arundel county, Maryland, October 22.

The patentee says,—"My propeller is of that kind which is known under the name of the spiral, and consists of a shaft which is to be placed in the direction of the vessel's length, and has on it a number of flights, or buckets, each of which approaches in form a segment of a spiral, but which are so arranged as not to act upon the water in the manner of those propellers, the spirals of which are continuous.

"The distinguishing feature of my propeller is the employment of a double set of spiral segments, flights, or buckets, the inner edges of one set of which are within a short distance of the shaft, and the outer edges of which terminate at a distance therefrom, which is on a line, or nearly so, with the inner edges of the larger set. The two sets of buckets may be eqnal in width, and supposing each set to form a continuous spiral around the shaft, the width of the larger would, in such case, be double that of the smaller spiral. The buckets of the larger series are supported on arms which extend out at right angles from the shaft. Each of these larger buckets may be a quarter of a circle in length, or nearly so, and they are to stand in pairs, one opposite to the other, their supporting arms being in the same right line. In the intervals between these, stand a pair of smaller buckets, which may also constitute a quadrant of a circle, or nearly so; these are sustained by short arms proceeding from the shaft. The second pair of larger buckets have their supporting arms at right angles to the first pair, and are placed at a suitable distance from them, which is such that their outer ends shall be at the same distance from the shaft, and the same may be said of the successive pairs of smaller buckets."

Claim.—"What I claim as constituting my improvement in the propelling of boats, and other vessels, is the forming and arranging of the buckets, or flights, of a spiral propelling wheel, in the manner herein set forth: that is to say, with alternate pairs of large and small buckets, so proportioned to each other, as that the outer edge of a small pair shall be in a line, or nearly so, with the inner edges of the larger wheels; and that the outer edges of each set shall stand in the direction of continuous spirals; the whole being otherwise combined together, substantially in the manner herein set forth."

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29. For an *Improvement in Daguerreotype Pictures;* John Plumbe, Jr., assignee of Daniel Davis, Boston, Massachusetts, October 22.

Claim.—"What I claim as my invention and discovery, and which I desire to secure by letters patent, is depositing metals, from their solutions upon the daguerreotype pictures for the purpose of giving them the desired tint, by connecting the pictorial plates with the negative pole of a galvanic battery, or magnetic electrical machine, and immersing them in the above solutions, or any other known solutions of metals, in the manner described, or any other substantially the same.

"I also claim in combination with the above process, the mode of tinting certain part, or parts, of the pictures, all as herein set forth."

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30. For an *Improvement in Lard and Oil Lamps;* F. H. Southworth, City of Washington, District of Columbia, October 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming a slot or perforation in the tube for allowing the lard or oil inside the wick to come in direct contact with the inner additional tube, for the purpose described, in combination with

the skeleton cylinder or conductor, for liquidizing and keeping the lard, outside the wick, in a liquid state."

31. For an *Improvement in Rat Traps;* Ebenezer Oliver, Philadelphia, Pennsylvania, October 22.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forcing of the rat, or other animal, into the apartment within which it is to be detained, by means of a revolving door, operated upon by a spiral, or other spring; the said door and spring being so combined with a platform, and other appendages, as that they shall co-operate in effecting the intended purpose, by an arrangement of parts, substantially the same with that herein described."

32. For an *Improvement in Trusses;* Edmund Landis, Lancaster, Pennsylvania, October 22.

The patentee says,—"The nature of my invention consists in the addition of a sleight spring, or springs, to the main spring of a truss, which passes round the body, as described."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the long spring with the main spring of the truss, to maintain an equal pressure on the rupture during every motion of the body, in the manner and for the purpose herein described.

"I also claim in combination with the springs, the spring adjusted by a screw, constructed and arranged as above described. I further claim the combination of the blocks placed obliquely on the abdomen over the inguinal canal, with the horizontal spring for giving a perpendicular pressure upon the parts affected."

33. For an *Improvement in Hemp Breaking;* Charles Learned, St. Louis, Missouri, October 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of combining the machine for whipping or cleaning with the heckling, so that the flax or hemp can be passed from one to the other by simply sliding it on the spring rest board, as described, by attaching the cleaning knives and heckling pins to the same drum, in the manner described."

34. For an *Improvement in the Reaction Steam Girator;* Louis Brutier, City of New York, October 25.

The patentee says,—"The main acting part of my engine consists of two arms of equal length, which are to be made to revolve in a vertical plane, said arms being placed upon an axis running horizontally, on suitable bearings.

"One of the revolving arms carries a small steam engine, which is to be supplied with steam from any suitable boiler or generator. At the outer end of each of these arms is what I denominate a steam receiver, into each of which steam is to be alternately admitted, and from which it is to be discharged in successive jets, instead of in con-

tinuous stream, as has been the practice with other reacting steam engines. The small steam engine which is carried by one of the arms, is a cylinder engine, and serves to open and close the orifices by which steam is admitted into, and those by which it is discharged from, the receivers, each of them having one orifice for its admission, and another for its discharge, the whole being furnished with slides so arranged, as that when the steam is being admitted into one of the receivers, the orifice for its discharge shall be closed, and that the action of the two receivers shall be reciprocal in this respect. The steam is supplied to them from the same boiler which supplies the small boiler.

"One end of the shaft which sustains and carries the revolving arms is made hollow, for the admission of steam to the engine cylinder, and to the receivers, its hollow end being received within a steam chamber which is supported on the frame work of the machine, and is connected by a steam pipe with the boiler."

Claim.—"What I claim as new, and desire to secure by letters patent, is the obtaining of the rotary motion of the arms of said machine by the successive and rapid discharges of steam through orifices, which orifices are made in steam receivers, and governed by valves, the supply of steam, and the reciprocal action of said valves, being effected and regulated by an arrangement of parts, substantially as herein made known. I also claim the employment of a small steam engine, attached to one of the revolving arms, and so connected and combined with the valves in the receivers, as to cause them to regulate the admission of steam into, and its discharge from, said receivers, for the purpose, and in the manner described. I will here observe that I have, in the first instance, claimed the manner in which I have constructed the receivers with their valves, for the supply and discharge of steam in successive instants, separately and distinctly from the claim to the employment of the small steam engine for opening and closing the valves in the receivers; and this I have done because I am aware that by means of tappets, or other devices, attached to the frame work of the engine, or to the case which surrounds it, the said valves might be made to open and close without the aid of the said steam engine, though not as I believe with equal advantage."

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35. For an *Improvement in Tenoning Machines;* William H. Harn, Chambersburg, Franklin county, Pennsylvania, October 26.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of constructing the said machine under the particular arrangement of the respective parts: that is to say, a machine in which the tenon is cut, by means of a vibrating plane, formed in the manner of a pilaster, or raising plane; and in which the stuff is held against the face of a sliding block, by means of a frame or holdfast, of iron, the apparatus being formed and operating in such manner as that the cutting shall be effected on the side of the stuff, as set forth. I claim, also, the manner of combining and operating the holdfast, for the purpose herein made known.

"I likewise claim the manner of gauging the shoulder of the tenon,

by means of the adjustable gauge piece; the whole instrument being constructed and arranged as herein described."

36. For an *Improvement in Horse Powers;* Albert W. Gray, Middletown, Rutland county, Vermont, October 26.

The patentee says,—" My horse power is of that kind which is actuated by the walking of the animal on an inclined plane formed in sections, which sections are hinged together, so as to constitute an endless floor. My principal improvement consists in the particular manner in which I construct the hinges, or connecting links, by which the sectional pieces constituting the floor are connected with each other, and in the manner in which I regulate the inclination of the floor, and support the same."

Claim.—" What I claim as new, and desire to secure by letters patent, is the particular manner in which I have formed and connected the hinges, or links, with their racks; said hinges extending from side to side, and from edge to edge, of each of the sectional pieces, constituting the movable floor, and the bolts passing through three pair of knuckle joints in each, and being otherwise constructed and arranged, as set forth."

37. For an *Improvement in Cutting Veneers, &c.;* John Humphreys, Harrington Township, Bergen county, New Jersey, October 26.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the arrangement of the parallel longitudinal adjustable knives for determining the width of the veneers or other thin pieces of wood to be cut, and the arrangement of the transverse parallel revolving knives for determining their lengths, in combination with the fixed blade for cutting the thin pieces of wood or veneers as described."

38. For an *Improvement in Separating Garlic from Wheat;* Samuel Fahrney, Boonsboro, Washington county, Maryland, October 26.

The patentee says,—" The nature of this invention consists in passing the wheat and garlic over inclined yielding surfaces, which surfaces shall have a pressure, by means of springs, on the grain, &c., sufficient to mash the garlic, or force it into cavities, but shall yield to the wheat and allow it to pass without disfiguring, and then by means of scrapers, or fingers, distributing the two in separate boxes.

Claim.—" What I claim as my invention, and which I desire to secure by letters patent, is the above described mode of separating garlic from wheat by means of the saw teeth formed on the edge of the plate, and spring bars for mashing the garlic into the apartments of said boxes, or any other mode substantially the same; and in combination therewith, the hopper, arranged and constructed as described."

39. For an *Improvement in Water Wheels;* William Miles, Boonsboro Washington county, Maryland, October 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of raising and lowering the wheel, by means of the cog wheels, lever, windlass, pulleys, and ropes, as decribed. Also the inclined arms with the floats, arranged in the manner and for the purpose set forth."

The Law of Patents—On an Improvement in the Machine for Pressing Palm Leaf Hats.

In the Circuit Court of the United States, (Boston, Massachusetts,) Chester Gorham *vs.* William Mixter *et al.*

This was an action on the case for an alleged infringement of a patent, for "an improvement in the machine for pressing palm-leaf hats."

The defence set up was—1st. That defendants had not infringed; or, in other words, that the machine used by them was substantially different in its construction and mode of operation, from the machine described in plaintiff's specification of claim in his letters patent.

2d. That plaintiff was not the original and first inventor of the machine patented, but that the same was known and used prior to his supposed invention thereof.

The plaintiff made application in the autumn of 1839, and obtained his letters in March, 1840.

The history of the art of pressing in this Commonwealth, so far as it was known to witnesses, was traced from 1830 to the trial.

In 1830, the machine in general use had three blocks for the hat, with a lever and flat to each, and the pressing of the rim, crown, and top of the hat was performed separately, at three successive operations on the respective blocks by removing the hat from block to block.

These blocks were attached by revolving shafts, which were moved by hand or any other power, as circumstances dictated; and the levers to which the pressing flats were attached were arranged, and the pressing done by hand.

In 1832, the plaintiff made an attempt to improve upon the old machine. He constructed a machine in which but one block was used, and made an angular flat to fit the side and top of the hat at the same time, thereby pressing the whole hat without removing it from the block. It did not appear in evidence, however, that by this arrangement the whole hat was pressed at one operation, without a change of flats.

A similar machine to the last, though somewhat improved in its structure, was shown to have been put in operation in 1834, by one Brown, of Dana, Mass., used for a time and abandoned.

Also, one Charles Rice, of Boston, testified for the defence, that in 1835 he constructed a machine of the same general character, using one lever and one flat; that in 1836 he added the second lever and

flat, making the two answer the purpose of the three flats; and in 1838 he added the third lever and fourth flat.

In this machine, the block shaft was turned, and the levers operated by hand, but the whole hat was pressed without changing flats.

In 1837, the plaintiff invented and put in operation a machine with one block, three levers, and the same number of flats, by which the hat in all its parts was pressed by one operation. The shaft was moved by water power, and the levers to which the flats were appended, were fastened by a catch, so as to press upon the hat while it revolved in connexion with the shaft, thus dispensing with the power of the operator and in a measure acting automatically.

In the machine patented by the plaintiff, four flats, two for the rim on opposite sides, one for the side of the crown, and one for the top, are attached to a sliding frame, which by means of a lever is brought to and removed from the hat-block at pleasure.

The hat is placed on a block with a table for the rim, on a vertical rotating shaft. After the hat is placed, the sliding frame is brought forward by means of the lever, bringing all the flats to their relative and proper position, over and against the hat. Then another lever is disengaged from the catch, which permits a weight to act upon a third lever, which in its turn acts upon the vertical shaft surmounted by the hat, and brings the hat in contact with the flats while the shaft revolves and thus the pressing is performed. After being thus put in motion, no further attention from the operator is required, until the hat is sufficiently pressed. One man can operate three or four machines at the same time, pressing from twelve to fifteen hundred hats per day, while on the old machine, one man could ordinarily press but five hundred in a day.

This machine, and what the plaintiff contended were modifications of it, came into general use soon after its construction, and superseded all that had gone before.

The defendant claimed that the modification used by them was an original invention of one Paul Hildreth, formerly of Petersham, made subsequently to plaintiff's invention and patent.

This was denied by the plaintiff, who insisted that it was taken from his machine, with alterations and modifications, for the purpose of evading the patent; but under the ruling of the court, it was immaterial as affecting plaintiff's right of recovery, whether an original invention or otherwise, being subsequent in point of time to plaintiff's invention and patent.

The point most strenuously urged by the defendants was, that their machine differed substantially from the one patented by plaintiff, and on this point, under the ruling of the Court, the case turned.

The question arose what plaintiff had claimed and patented,—whether a machine, *as* a machine, new in its structure as a whole, or merely a new combination of old parts; and if a combination merely, whether a combination effected by any mechanism, or a combination effected by *the* means, and operating in the particular manner described in his specification of claim. If the latter, the question of priority

of invention was disposed of, for it was not pretended that any prior machine contained the same combination *constructed* and *operating* in the same way.

But it was contended on the part of the defendants, that if this construction were given to the claim, they did not infringe, as some of the elements of combination in their machine were constructed and operated substantially different from corresponding elements in plaintiff's.

On the question of identity of machines, the plaintiff called as experts Thomas Blanchard and R. H. Eddy, of Boston, and the defendants called Charles M. Keller, of New York city.

Sprague, J., charged the jury, that the plaintiff had claimed and patented a combination, constructed and operating as described in his specification, and to that he was limited; that to constitute an infringement, the defendant must have used the same combination, constructed and operating substantially in the same way; that if they had only used two of the three elements of combination, it was not an infringement. Nor was it an infringement, if any one or all their elements of combination were constructed and operated substantially different from plaintiff's.

Yet a mere change in form or proportion, or substitution of mechanical means or equivalents, in any one or all the elements, producing the same result, would not constitute a substantial difference within the meaning of the patent law. Nor would it be a defence, that they had added to the combination, or any element thereof, and made improvements, provided they used plaintiff's combination, constructed and operating substantially in the same way.

Such additions and improvements, though meritorious, gave them no right to appropriate what belonged to another without making compensation. It was for the jury to say, in view of the evidence, under the instructions of the Court, and from an inspection of the models before them, whether the defendants' machine did in fact contain the combination claimed and patented by plaintiff, constructed and operating substantially in the same way.

The jury returned a verdict for the plaintiff, and assessed damages at \$1110—\$10 of which was for the use of machines, and \$600 for counsel fees.

Rufus Choate and H. E. Smith, for plaintiff. B. R. Curtis and Cyrus Cummings, for defendants.

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines. By M. V. Regnault.

SIXTH MEMOIR.

On the Compressibility of Elastic Fluids.

(Continued from page 196.)

Tables of the Results of the Experiments upon the Compressibility of Elastic Fluids.

In the first column of the table is placed the number of the experiment.

The second column gives the temperature of the water in which the tube containing the gas was immersed.

The third column records the volume of the gas expressed in grammes of mercury. These volumes were reduced, by calculation, to the temperatures given in column 5, which differ very little from the observed temperatures in column 2. This change was made to facilitate the comparison.

In column four are given the elastic forces of the gas expressed in columns of mercury at 0°, the corrections before indicated having been applied to them.

The experiments in the same series having been made upon the same quantity of gas, the numbers of the vertical columns 3 and 4 may be combined in any order, provided the volumes V are at the same temperature, which may be ascertained by consulting the column No. 5. The second parts of the tables contain the results of these combinations. All possible combinations could not be calculated on account of their number, but those used were taken at random.

Column No. 6 contains the numbers of the experiments combined.

Column No. 7 contains the ratio of the volumes, $\frac{V_0}{V_1}$.

Column No. 8 contains the inverse ratio of the corresponding elastic forces, or $\frac{P_1}{P_0}$.

In columns Nos. 9 and 10 are recorded the quotients obtained by dividing the ratio $\frac{V_0}{V_1}$ by the corresponding ratio $\frac{P_1}{P_0}$. These quotients are placed in No. 9 when the volumes of the gas were nearly as 1 to 2; and in No. 10 when they were in any other ratio.

If then the law of Mariotte be true, the numbers in columns 9 and 10 should be always 1; whereas for atmospheric air it is always greater than unity, and increases very regularly as the elastic forces become greater.

TABLE I.—*Compressibility of Atmospheric Air.*

1	2	3	4	5	6	7	8	9	10
Number of the Experiment.	Temperature of the Water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{V_0}{V_1} \Big/ \frac{P_1}{P_0}$	$\frac{V_0}{V_1} \Big/ \frac{P_1}{P_0}$
1	4·44°	1939·69	738·72	4·44°	1— 2	2·001215	1·998389	1·001414	
2	4·41	969.26	1476·25	4·44					
3	4·40	1939.69	738·99	4·40	3— 4	1·999990	1·997076	1·001448	
4	4·40	969·86	1475·82	4·40					
5	4·40	1940·21	739·07	4·40	5— 6	2·000010	1·997565	1·001224	
6	4·41	970·10	1476·34	4·40					
7	4·43	1939·47	739·19	4·43	7— 8	2·000701	1·997863	1·001421	
8	4·44	969·39	1476·80	4·43					
9	4·64	970·63	4209·48	4·68	9—10	1·998135	1·992625	1·002765	
10	4·64	1939·45	2112·53	"					
11	4·68	970·57	4208·97	"	11—12	1·998732	1·993232	1·002759	
12	4·68	1939·91	2111·63	"					
13	4·68	970·00	4212·14	"	13—15	1·998705	1·993714	1·002503	
14	4·71	642·78	6350·33	"	12—14	3·017955	3·007302	"	1·003539
15	4·74	1938·74	2112·69	"	14—15	3·016180	3·005803	"	1·003452
16	4·70	642·87	6350·35	"	15—16	3·015758	3·005813	"	1·003309
17	5·03	969·32	4127·82	4·88	17—18	2·001258	1·995851	1·002709	
18	5·03	1939·88	2068·20	"	18—19	2·000158	1·994725	1·002724	
19	4·96	969·86	4125·49	"	20—21	2·002485	1·996491	1·002713	
20	4·96	969·86	4125·13	"	21—22	2·002629	1·997580	1·002528	
21	4·96	1942·13	2066·19	"					
22	4·88	969·79	4127·38	"	23—24	1·997287	1·991516	1·002898	
23	4·85	969·90	4126·86	"					
24	4·85	1937·16	2072·22	"	24—25	1·996143	1·991643	1·002762	
25	4·85	969·97	4127·12	"					
26	4·89	979·87	8177·48	4·91	26—27	1·981270	1·974845	1·003253	
27	4·91	1941·39	4140·82	"	27—28	1·981556	1·975456	1·003090	
28	4·91	979·73	8179·92	"					
29	4·91	979·73	8178·09	"	29—30	1·980045	1·973530	1·003302	
30	4·91	1939·91	4143·89	"					
31	4·90	970·64	8404·11	4·90	31—32	1·998588	1·991944	1·003336	
32	4·90	1939·91	4219·05	"	33—34	1·999690	1·992726	1·003495	
33	4·87	970·18	8407·75	"	35—36	1·998726	1·992084	1·003335	
34	4·87	1940·01	4219·22	"	39—38	2·000050	1·993179	1·003448	
35	4·95	1939·48	4219·05	"					
36	4·96	970·36	8404·70	"	35—37	3·093714	3·076985	"	1·005437
37	4·90	626·91	12981·95	"	37—39	3·094512	3·076964	"	1·005703
38	4·87	969·97	8409·38	"					
39	4·88	1939·98	4219·08	"					
40	4·86	1939·86	6770·15	4·80	40—41	2·000143	1·991607	1·004286	
41	4·80	969·86	13483·48	"	43—44	2·001117	1·990148	1·004512	
42	4·81	685·11	19002·13	"	44—45	2·001454	1·992293	1·004599	
43	4·85	970·03	13468·33	"	48—49	1·996511	1·987409	1·004580	
44	4·73	1941·15	6767·50	"	40—42	2·831456	2·807490	"	1·008536
45	4·74	969·87	13482·84	"	42—44	2·833341	2·808590	"	1·008813
46	4·74	674·81	19312·50	"	44—46	2·876588	2·853713	"	1·008016
47	1·74	675·49	19291·33	"	47—49	2·871502	2·848530	"	1·008064
48	4·73	971·53	13459·49	"	46—49	2·874395	2·851656	"	1·007980
49	4·72	1939·67	6772·38	"					
50	4·81	1942·20	6387·41	4·81	50—51	2·001463	1·992273	1·004611	

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
51	4·86°	970·39	12725·02	4·81°	53—54	2·001151	1·991687	1·004752	
52	4·82	633·82	19399·54	"					
53	4·85	969·58	12732·16	"	50—52	3·064280	3·037153	"	1·008930
54	4·78	1940·27	6392·65	"	52—54	3·061230	3·034664	"	1·008755
55	4·70	1939.91	9336·41	4·70	55—56	1·999610	1·986962	1·006366	
56	4·62	970·13	18551·09	"					
57	4·65	1940·49	9332·82	"	57—58	2·000060	1·987867	1·006132	
58	4·60	970·22	18552·41	"					
59	4·62	971·56	18532·90	"	59—60	1·997718	1·985784	1·006010	
60	4·58	1940·91	9332·79	"	60—61	2·000198	1·987585	1·006346	
61	4·76	970·36	18549·71	"					
62	4·76	970·36	18548·98	"					
63	4·61	1945·33	11472·00	4·61	63—64	1·838150	1·827878		1·005619
64	4·55	1058·31	20969·42	"	64—65	1·837653	1·827378		1·005622
65	4·58	1944·80	11475·14	"	65—66	1·853518	1·842642		1·005902
66	4·61	1049·25	21144·57	"					

TABLE II.—*Compressibility of Nitrogen Gas.*

1	5·09	969·65	1506·24	5·09	1— 2	1·999794	1·997771	1·001012	
2	5·09	1939·10	753·96	"	2— 3	1·999434	1·996206	1·001617	
3	5·10	969·82	1505·06	"	3— 4	1·999506	1·997531	1·000988	
4	5·09	1939·17	753·46	"	4— 5	1·999506	1·998208	1·000650	
5	5·10	969·82	1505·57	"	5— 6	1·999359	1·997784	1·000788	
6	5·12	1939·03	753·62	"					
7	5·06	1939·53	1159·26	5·08	7— 8	1·999806	1·997817	1·000996	
8	5·08	969·86	2315·99	"	8— 9	1·999670	1·997524	1·001074	
9	5·09	1939·40	1159·43	"	10—11	1·998660	1·996507	1·001068	
10	5·08	970·35	2314·79	"	11—12	2·001061	1·999034	1·001014	
11	5·09	1939·40	1159·42	"					
12	5·07	969·18	2317·72	"					
13	5·11	969·90	4311·97	5·14	13—14	1·999065	1·996874	1·001097	
14	5·18	1938·89	2159·36	"	14—15	1·999433	1·997537	1·000966	
15	5·18	969·72	4313·83	"	15—16	2·000041	1·997282	1·001381	
16	5·18	1938·48	2159·60	"	16—17	2·000037	1·997398	1·001321	
17	5·14	969·72	4313·58	"	17—18	2·000330	1·997842	1·001245	
18	5·14	1939·76	2159·12	"					
19	5·03	970·25	6058·79	5·10	19—20	2·003354	1·999454	1·001950	
20	5·08	1943·75	3030·22	"	20—21	2·004084	2·000175	1·001955	
21	5·09	969·89	6060·97	"	21—22	1·998978	1·995309	1·001840	
22	5·10	1938·80	3037·61	"	22—23	1·998767	1·994910	1·001936	
23	5·14	970·00	6059·73	"					
24	4·95	970·14	7799·55	5·01	24—25	1·999840	1·994744	1·002555	
25	4·97	1940·12	3910·05	"	25—26	2·000341	1·996120	1·002115	
26	4·98	969·90	7804·93	"	28—29	1·999981	1·994923	1·002536	
27	5·02	577·19	13070·53	"	29—30	1·999691	1·994948	1·002377	
28	5·03	969·93	7798·91	"	32—33	2·000169	1·994954	1·002664	
29	5·01	1939·84	3909·38	"					
30	5·01	970·07	7799·02	"	25—27	3·361320	3·342803		1·005541
31	5·08	594·21	12700·20	"	27—29	3·360834	3·343377		1·005222
32	5·16	969·66	7800·12	"	29—31	3·264570	3·248648		1·004901
33	5·07	1939·48	3910·12	"	31—33	3·263970	3·248033		1·004907
34	4·96	970·49	9873·23	4·96	34—35	1·998897	1·993013	1·002952	
35	4·96	1939·91	4953·92	"	35—36	1·999762	1·994059	1·002860	

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
36	4·96°	970·07	9878·41	4·96°	38—39	1·999907	1·994263	1·002830	
37	4·97	604·35	15811·66	“	39—40	2·000049	1·994502	1·002781	
38	4·97	969·93	9879·56	“	42—43	2·000486	1·994961	1·002769	
39	4·98	1939·77	4953·99	“					
40	4·96	969·86	9880·74	“	35—37	3·209911	3·191748	“	1·005691
41	4·98	602·13	15870·52	“	37—39	3·209676	3·191703	“	1·005630
42	5·00	969·65	9882·40	“	39—41	3·221510	3·203583	“	1·005596
43	4·98	1939·77	4953·68	“	41—43	3·221500	3·203784	“	1·005533
44	4·93	970·03	11875·10	4·86	44—45	1·999987	1·993149	1·003431	
45	4·85	1940·05	5957·96	“	45—46	2·000196	1·993675	1·003271	
46	4·86	969·93	11878·24	“	48—49	2·000636	1·993104	1·003779	
47	4·81	606·31	18941·11	“	49—50	2·000341	1·993935	1·003213	
48	4·92	969·72	11875·73	“	52—53	2·000560	1·993619	1·003481	
49	4·85	1940·05	5958·41	“					
50	4·86	969·86	11880·68	“	45—47	3·199767	3·179127	“	1·006493
51	4·86	603·42	19027·80	“	47—49	3·199767	3·178886	“	1·006569
52	4·88	969·72	11881·79	“	49—51	3·215091	3·193435	“	1·006782
53	4·85	1939·98	5959·92	“	51—53	3·215975	3·192631	“	1·006999
54	4·98	1940·51	7294·47	4·96	54—55	2·000237	1·992725	1·003770	
55	4·98	970·14	14535·87	“	57—58	2·000959	1·993935	1·003523	
56	4·96	690·78	20351·90	“	60—61	1·999910	1·991768	1·004088	
57	4·96	1940·65	7293·84	“	61—62	1·999978	1·992084	1·003963	
58	4·96	969·86	14543·44	“					
59	4·95	685·74	20493·29	“	54—56	2·809154	2·790046	“	1·006849
60	4·90	970·07	14534·63	“	56—57	2·809360	2·790286	“	1·006836
61	4·94	1940·05	7297·35	“	57—59	2·830010	2.809670	“	1·007239
62	4·93	970·03	14536·93	“	59—61	2·829136	2·808318	“	1·007413
63	5·20	1939·91	7297·06	5·20	63—64	2·000196	1·992373	1·003924	
64	5·20	969·86	14538·50	“	66—67	2·000495	1·992180	1·004174	
65	5·17	689·04	20394·93	“	67—68	2·000568	1·992570	1·004014	
66	5·21	969·82	14537·09	“	70—71	2·001170	1·993065	1·004287	
67	5·21	1940·13	7297·08	“					
68	5·22	969·79	14539·94	“	63—65	2·815380	2·794951	“	1·007309
69	5·25	687·03	20447·42	“	65—67	2·815700	2·794944	“	1·007426
70	5·27	969·61	14538·85	“	67—69	2·823939	2·802137	“	1·007779
71	5·22	1940·36	7296·32	“	69—71	2·824270	2·802429	“	1·007793
72	5·07	1941·81	8628·54	5·13	72—73	2·008706	1·999174	1·004768	
73	5·08	966·70	17249·95	“	75—76	2·007120	1·997684	1·004723	
74	5·09	801·34	20789·40	“	76—77	2·007408	1·998213	1·004602	
75	5·15	966·59	17250·20	“	79—80	2·007302	1·998280	1·004515	
76	5·13	1940·06	8635·18	“					
77	5·13	966·45	17254·93	“	72—74	2·423203	2·409377	“	1·005739
78	5·18	799·66	20827·79	“	74—76	2·421020	2·407546	“	1·005596
79	5·18	966·69	17250·54	“	76—78	2·426106	2·411969	“	1·005861
80	6·18	1940·44	8632·69	“	78—80	2·426585	2·412665	“	1·005769
81	4·90	1942·04	9767·42	4·93	81—82	2·001963	1·991712	1·005147	
82	4·87	970·07	19453·89	“	82—83	1·999845	1·990576	1·004657	
83	4·94	1939·99	9772·99	“	83—84	1·999869	1·989973	1·004822	
84	4·90	970·10	19447·99	“	84—85	1·999907	1·989894	1·005032	
85	4·90	1940·12	9773·38	“	85—86	1·999549	1·990418	1·004588	
86	4·93	970·28	19453·12	“	86—27	1·999725	1·990011	1·004881	
87	4·98	1940·29	9775·38	“					
88	4·09	1942·84	10981·42	4·09	88—89	1·931636	1·919244	“	1·006456

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
89	4·10°	1005·80	21076·03	4·09°	89—90	1·931488	1·919378	"	1·006309
90	4·09	1942·69	10980·66	"	90—91	1·935760	1·923338	"	1·006458
91	4·09	1003·58	21119·52	"	91—92	1·936140	1·924005	"	1·006307
92	4·08	1943·07	10976·85	"	92—93	1.937781	1·925166	"	1·006552
93	4·12	1002·73	21132·28	"	93—94	1·935115	1·924931	"	1·006784
94	4·08	1943·28	10978·20	"					

TABLE III.—*Compressibility of Carbonic Acid Gas.*

1	2	3	4	5	6	7	8	9	10
1	3·28	969·89	1516·00	3·28	1— 2	1·999289	1·984225	1·007597	
2	3·28	1939·10	764·03	"					
3	3·29	969·25	1518·42	"	3— 4	2·001740	1·986395	1·007725	
4	3·23	1940·19	764·41	"					
5	3·28	969·72	1516·62	"	5— 6	2·000630	1·985469	1·007636	
6	3·27	1940·05	763·86	"					
7	3·26	1939·68	765·77	3·27	7— 8	1·998515	1·981835	1·008416	
8	3·25	970·56	1517·63	"					
9	3·27	1939·91	765·01	"	9—10	1·998732	1·983268	1·007797	
10	3·27	970·57	1517·22	"	10—11	1·997897	1·982231	1·007903	
11	3·28	1939·10	765·41	"					
12	3·29	969·96	2789·17	3.31	12—13	1·995740	1.971465	1·012313	
13	3·29	1935·61	1414·77	"					
14	3·29	969·93	2788·84	"					
15	3·33	1939·70	1412·94	"	15—16	1·999835	1·974288	1·012940	
16	3·33	969·93	2789·55	"					
17	3·30	1939·91	1413·46	"					
18	3·31	970·28	2788·79	"	17—18	1·999331	1·973024	1·013333	
19	3·32	1939·84	1412·70	"	18—19	1·999256	1·974085	1·012751	
20	3·43	970·18	4246·71	3·32	20—21	1·998921	1·961701	1·018973	
21	3·31	1939·31	2164·81	"					
22	3·32	969·79	4247·28	"	22—23	1·999732	1·962418	1·019014	
23	3·32	1939·32	2164·31	"					
24	3·32	969·86	4247·41	"	24—25	2·000188	1·962043	1·019442	
25	3·30	1939·90	2164·79	"					
26	3·26	969·86	4247·23	"	26—27	2·000630	1·962431	1·019465	
27	3·26	1940·33	2164·27	"					
28	3·56	970·18	6202·71	3·65	28—29	2·002654	1·946785	1·028698	
29	3·62	1942·93	3186·13	"	29—30	2·003238	1·947739	1·028494	
30	3·62	969·90	6205·75	"	32—33	2·004862	1·948327	1·029017	
31	3·65	493·91	11526·98	"	33—34	2·003833	1·948274	1·028517	
32	3·65	969·86	6203·61		36—37	2·003392	1·947530	1·028684	
33	3·69	1944·44	3184·07	"					
34	3·69	970·36	6203·44	"	29—31	3·933780	3·617862	"	1·087322
35	3·71	518·42	11045·25	"	31—33	3·936821	3·620202	"	1·087460
36	3·74	969·47	6208·12	"	33—35	3·750696	3·468910	"	1·081232
37	3·74	1942·23	3187·69	"	35—37	3·746442	3·464971	"	1·081232
38	3·56	970·00	7357·51	3·56	38—39	2·000127	1·932414	1·035040	
39	3·54	1940·12	3807·42	"	39—40	1·999982	1·932792	1·034763	
40	3·56	970·07	7358·95	"	42—43	2·000124	1·932620	1·034929	
41	3·56	612·93	11193·20	"	43—44	2·000268	1·933363	1·034606	
42	3·56	969·86	7358·69	"	46—47	1·999907	1·932720	1·034763	
43	3·56	1939·84	3807·61	"					

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
44	3·56°	969·79	7361·49	3.56°	39—41	3·165324	3·018577	"	1·076700
45	3·56	612·32	11198·95	"	41—43	3·164864	3·018427	"	1·076597
46	3·56	970·00	7358·21	"	43—45	3·168016	2·941201	"	1·077116
47	3·56	1939·91	3807·18	"	46—47	3·168130	2·941533	"	1·077034
48	3·21	1939·10	4879·77	3·20	48—49	1·999577	1·912328	1·045625	
49	3·21	969·75	9331·72	"	51—52	2·001917	1·914310	1·045760	
50	3·20	594·32	14376·80	"	52—53	2·001876	1·914792	1·045070	
51	3·20	969·36	9333·18	"	55—56	2·000415	1·913018	1·045685	
52	3·20	1940·57	4875·48	"					
53	3·20	969·86	9334·54	"	48—50	3·262720	2·946205	"	1·107431
54	3·20	589·46	14478·45	"	50—52	3·265198	2·948797	"	1·107296
55	3·26	969·65	9329·77	"	52—54	3·292118	2·969640	"	1·108590
56	3·23	1939·70	4876·99	"	54—56	3·290633	2·968720	"	1·108435
57	3·16	1939·25	6820·22	3·16	57—58	1·999660	1·875613	1·066137	
58	3·16	969·79	12792·09	"	60—61	1·999433	1·875463	1·066101	
59	3·16	553·34	20284·08	"					
60	3·16	969·86	12790·74	"	57—59	3·504624	2·976850	"	1·177293
61	3·16	1939·17	6820·07	"	59—61	3·504481	2·976916	"	1·177220
62	3·15	1939·91	8393·68	3·15	62—63	2·001516	1·845943	1·084278	
63	3·15	969·22	15493·00	"	65—66	2·000197	1·844043	1·084680	
64	3·14	670·62	20766·50	"	66—67	2·000940	1·844647	1·084672	
65	3·15	969·86	15481·24	"	69—70	1·997970	1·842618	1·084310	
66	3·14	1939·91	8395·27	"					
67	3·15	969·50	15487·01	"	62—64	2·892713	2·474063	"	1·169215
68	3·15	675·87	20648·15	"	64—66	2·892713	2·473596	"	1·169437
69	3·15	970·57	15470·37	"	66—68	2·870242	2·459500	"	1·167003
70	3·15	1939·17	8395·86	"	68—70	2·869147	2·459325	"	1·166640
71	2·66	1935·25	9620·06	2·68	71—72	1·994456	1·813421	1·099830	
72	2·67	970·31	17445·23	"	74—75	1·995546	1·814813	1·099588	
73	2·67	774·75	20791·02	"	76—77	1·995978	1·814671	1·099912	
74	2·68	969·86	17452·18	"	79—80	1·996453	1·815851	1·099459	
75	2·68	1935·40	9619·52	"					
76	2·68	1935·40	9619·97	"	71—73	2·497903	2·161214	"	1·155787
77	2·68	969·65	17457·08	"	73—76	2·498096	2·161235	"	1·155865
78	2·69	779·67	20689·05	"	76—78	2·482332	2·150635	"	1·154232
79	2·70	969·72	17453·67	"	78—80	2·483100	2·152331	"	1·153681
80	2·70	1936·00	9612·39	"					

TABLE IV.—*Compressibility of Hydrogen Gas.*

1	4·40	969·19	4431·14	4·41	1— 2	2·001134	2·003971	0·998584	
2	4·41	1939·47	2211·18	"	5— 6	2·003048	2·004305	0·999373	
3	4·43	969·78	4428·19	"					
4	4·43	402·30	10715·19	"					
5	4·41	968·37	4432·90	"	2— 4	4·820120	4·845916	"	0·994676
6	4·40	1939·69	2211·69	"	4— 6	4·820666	4·844798	"	0·995020
7	4·22	969·86	7999·09	4·22	7— 8	2·000196	2·005051	0·997578	
8	4·22	1939·91	3989·47	"	8— 9	2·000484	2·006582	0·996961	
9	4·22	969·72	8005·20	"					
10	4·23	563·34	13832·05	"	8—10	3·443585	3·467140	"	0·993206
11	4·23	389·95	20110·99	"	8—12	3·433287	3·455545	"	0·993559
12	4·23	565·03	13785·79	"	8—11	4·974765	5·041017	"	0·986857

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
13	4·38°	1939·17	3992·10	4·22°					
14	4·38	970·57	7998·82	"	13—14	1·997970	2·003662	0·997159	
15	3·92	1939·54	5845·18	3·92	15—16	1·999381	2·007166	0·996121	
16	3·92	970·07	11732·25	"	16—18	2·000380	2·008764	0·995826	
17	3·97	601·60	19002·88	"	19—20	2·001310	2·009197	0·996074	
18	3·94	1940·51	5840·53	"	22—23	1·999896	2·007781	0·996073	
19	4·19	1940·57	5847·16	4·19					
20	4·19	969·65	11748·10	"	15—17	3·225580	3·250862	"	0·991433
21	4·19	566·09	20254·36	"	17—18	3·223970	3·253450	"	0·991727
22	4·18	969·89	11744·76	"	19—21	3·426470	3·463965	"	0·989592
23	4·19	1939·69	5849·62	"	21—23	3·428024	3·462508	"	0·989624
24	3·87	1939·84	9176·50	3·86	24—25	2·000709	2·014948	0·992933	
25	3·74	969·58	18490·17	"	27—28	2·001034	2·014534	0·993297	
26	3·86	858·36	20904·89	"	24—27	2·000865	2·014162	0·993349	
27	3·86	969·50	18483·88	"	28—29	2·000652	2·014500	0·993126	
28	3·94	1940·00	9175·25	"	31—32	2·001746	2·014602	0·993618	
29	3·87	969·69	18483·54	"	33—36	2·000340	2·013762	0·993335	
30	3·94	862·16	20807·95	"					
31	3·89	969·18	18485·42	"	24—26	2·259936	2·278090	"	0·992031
32	3·87	1940·06	9175·72	"	26—28	2·260127	2·278400	"	0·991980
33	3·86	969·79	18478·94	"	28—30	2·250230	2·267834	"	0·992290
34	3·86	854·94	20985·19	"	30—32	2·250165	2·267718	"	0·992209
35	3·86	969·93	18473·33	"	32—34	2·269060	2·287034	"	0·992207
36	3·86	1939·91	9176·33	"	34—36	2·269234	2·286883	"	0·992217

TABLE V.—*Compressibility of Hydrogen Gas.*

1	10·02	968·97	11165·36	10·00	1— 2	2·002025	2·009850	0·996107	
2	10·00	1939·91	5555·32	"	2— 3	2·002314	2·010480	0·995938	
3	10·02	968·83	11168·86	"	5— 6	2·001516	2·009609	0·995973	
4	10·01	559·19	19463·09	"	6— 7	2·000557	2·008684	0·995954	
5	10·01	969·22	11161·57	"	9—10	2·001092	2·009453	0·995839	
6	10·01	1939·91	5554·10	"					
7	10·02	969·68	11156·43	"	2— 4	3·469142	3·503505	"	0·989974
8	10·01	559·34	19459·74	"	4— 6	3·469142	3·504274	"	0·990192
9	10·02	969·61	11160·04	"	2— 8	3·468212	3·502902	"	0·989880
10	10·03	1940·29	5553·77	"	6— 8	3·468212	3·503671	"	0·990097
11	9·62	1939·98	7074·96	9·62	11—12	2·000412	2·011075	0·994697	
12	9·62	969·79	14228·28	"	12—13	2·001103	2·011974	0·994597	
13	9·61	1940·65	7071·80	"	13—14	2·001557	2·012350	0·994636	
14	9·62	969·57	14230·94	"	14—15	2·001401	2·011770	0·994846	
15	9·62	1940·50	7073·84	"	15—16	2·000804	2·011390	0·994737	
16	9·62	969·86	14228·25	"	16—17	2·000959	2·011765	0·994628	
17	9·62	1940·65	7072·52	"					
18	9·66	1940·86	9147·61	9·69	18—19	2·000168	2·013745	0·993258	
19	9·69	970·35	18420·96	"	19—20	1·999939	2·013624	0·993203	
20	9·68	1940·64	9148·16	"	20—21	2·001094	2·014892	0·993152	
21	9·69	969·79	18432·55	"	21—22	2·001167	2·014711	0·993277	
22	9·67	1940·71	9148·98	"	22—23	2·001167	2·014649	0·993308	
23	9·69	969·79	18431·93	"					
24	9·73	1939·34	10361·88	9·65	24—25	1·999540	2·015000	0·992327	

1	2	3	4	5	6	7	8	9	10
Number of the experiment.	Temperature of the water. (t)	Corrected volume of the gas. V	Elastic force reduced to 0°. P	Normal temperature. t'	Numbers of the experiments combined.	$\frac{V_0}{V_1}$	$\frac{P_1}{P_0}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$	$\frac{\frac{V_0}{V_1}}{\frac{P_1}{P_0}}$
25	9·66°	969·89	20879·18	9·65°	25—26	2·001043	2·016423	0·992373	
26	9·64	1940·80	10354·59	"	26—27	1·999650	2·015158	0·992304	
27	9·65	970·57	20866·14	"	27—28	1·999568	2·014913	0·992384	
28	9·64	1940·72	10355·85	"	28—29	2·000745	2·015827	0·992518	
29	9·67	970·00	20875·60	"	29—30	1·999909	2·015050	0·992485	
30	9·65	1939·91	10359·84	"					
31	9·65	1940·62	11158·81	"	31—32	1·880682	1·893271	"	0·993297
32	9·66	1031·87	21127·77	"	32—33	1·880226	1·893033	"	0·993235
33	9·64	1940·15	11160·80	"	33—34	1·882690	1·895529	"	0·993227
34	9·65	1030·52	21155·62	"	34—35	1·882622	1·895257	"	0·993333
35	9·65	1940·08	11162·40	"	35—36	1·885289	1·898066	"	0·993271
36	9·65	1029·06	21186·97	"	36—37	1·885820	1·899051	"	0·993032
37	9·65	1940·62	11156·61	"					
38	9·00	1941·45	11126·62	9·03	38—39	1·833840	1·845004	"	0·993949
39	9·03	1058·68	20528·67	"	39—40	1·832564	1·844123	"	0·993732
40	9·03	1940·10	11131·94	"					
41	8·94	1940·60	12512·92	8·95	42—43	1·636558	1·645227	"	0·994730
42	8·95	1185·80	20576·78	"	43—44	1·637772	1·646029	"	0·994984
43	8·95	1940·63	12513·03	"	44—45	1·637773	1·645807	"	0·995118
44	8·95	1184·92	20596·80	"	45—46	1·639900	1·649134	"	0·994401
45	8·95	1940·10	12514·71	"	46—47	1·640153	1·649291	"	0·994460
46	8·94	1183·06	20638·43	"					
47	8·95	1940·40	12513·51	"					

(To be Continued.)

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Paddle-Wheels.

The following thoughts on paddle-wheels are respectfully submitted: As I have not kept the run of recent propositions on the subject, it is possible that the view I have taken may be neither novel nor correct: if so, I can only claim the merit of having suggested what I thought *might* be both useful and new. But theory is one thing and practice another. The former is polite and complaisant; the latter, a sturdy, inflexible fellow, that no coaxing can soften. One will often accompany a votary in his wanderings, the other won't deviate a hair's-breadth if an inventor's salvation depended upon it.

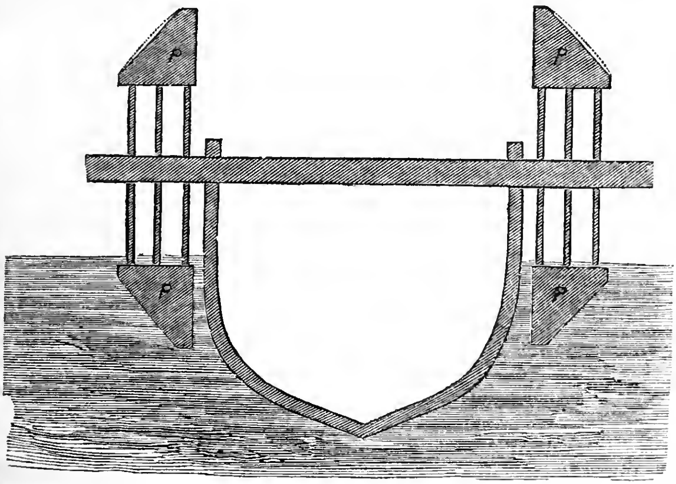
That any plan involving movements of paddles on their arms, with the view of feathering them, and more especially their suspension on pinions for that purpose, will never receive the sanction of modern engineers, I feel fully persuaded. Such wheels are too complex to be trusted, particularly on the ocean, while their auxiliary movements are all but incompatible with the requisite velocity of the chief one. Notwithstanding innumerable projects for improving or superseding it, the old paddle-wheel still holds its own, and like the oar, seems to deride all

attempts to beat it. In modern steamers it scarcely differs an iota from those used in Roman galleys, mediæval ferry-boats.

Paddles in use are rectangular blades, arranged parallel to the shafts to which they are attached, and around which they necessarily describe cylinders. They constitute cylindrical paddle-wheels. Their acknowledged defects are chiefly two. 1. When they strike the water their tendency is rather to depress it than to cast it behind them, which in fact they cannot do, till, in their progress downwards, they are passing or about to pass under their axes; hence a portion of the power that drives them is wasted on indirect action. 2. So also when rising to the surface, they lift the fluid, produce what is called backwater, and thereby uselessly expend another portion of the motive treasure. Viewed in connexion with a boat at rest, these are serious drawbacks. To a certain extent they are diminished with her speed; still they are drawbacks, and, unfortunately, are inseparable from fixed blades revolving in circles round their axes.

The question then is: Can anything be done to make *fixed* paddles more efficient by *lessening* the water's resistance to them at those parts of their stroke or sweep, when their propelling property is weakest, and without adding to it when that property is greatest.

I submit that, in some degree, this desideratum may be realized by *conical* paddle-wheels. These may be made either by altering the figure of common paddles, or their position on the arms, viz: by inclining them to their shafts. Of obvious modifications of such wheels, one will be sufficient for an illustration.



Paddles shaped like *p p*, instead of uselessly striking the surface of the water with their entire length, dip first their pointed extremities, and when half their depth is immersed the larger part of their faces will be still without, contrary to rectangular ones, whose immersed areas increase *pari passu* with their dip. Here, the most powerful part of the blade is withheld from the water till it can be brought into

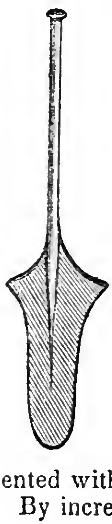
play with the best effect; the largest amount of propelling surface being introduced when it is most wanted, and not before. Like the feathering of oars and paddles, the surface is virtually diminished when its presence is injurious, and enlarged when it is most desirable.

But some will perhaps say, True, the blade dips with its point, but its base is the first to emerge, and consequently encounters a resistance equal to that evaded on entering. Not at all. It would be really so, if that base were as far out from the shaft as the point or apex, not otherwise. The resistance to a blade on leaving the water is greatest at its extremity, and increases of course with the width at that extremity. The outer edges might probably be slightly curved with advantage, so as to make each paddle a portion of an ellipse, as shown by dotted lines at $p'\ p'$.

I may be mistaken, but I think such paddles will be found preferable to ordinary shaped ones of equal surface. Besides being generally more efficient, they will cause less jar or tremor on striking the water; the shaft virtually will be strengthened, by withdrawing the strain from its outer ends—its weakest parts—to where it is stronger, and the work will be brought nearer to the power. When a cylindrical wheel is submerged by a vessel lurching, the strain on the submerged end of the shaft is extreme; but this can never happen to conical wheels, because of the reduced surface of the outer ends of the paddles.

To determine the best form of paddles—to ascertain whether it is better to extend them abroad from the sides of a vessel, or give them a greater dip and keep them nearer home—and, lastly, to find the limits outwards and downwards which yield the highest results—are problems interesting in themselves, and whose solution is of increasing importance to the world at large.

It is remarkable that the parent instrument, the Indian paddle, is invariably long and pointed. Find it where we will—in the hands of savages, semi-tutored, or the civilized—the end is spear-shaped. To what is this uniform result due, if not to experience? How is it that human sagacity in all times, as well as climes, has wrought the same figure out? If not possessing superior advantages, some tribes would surely have adopted another. But no. Everywhere man, as if impelled by a common instinct, has selected it. From its perpendicular position and action, it gave its name to our wheels. They are revolving paddles. Speed has always been a prime object in the propulsion of canoes. Is there any essential difference between them and steamers, to require a different form and proportions in propelling blades?



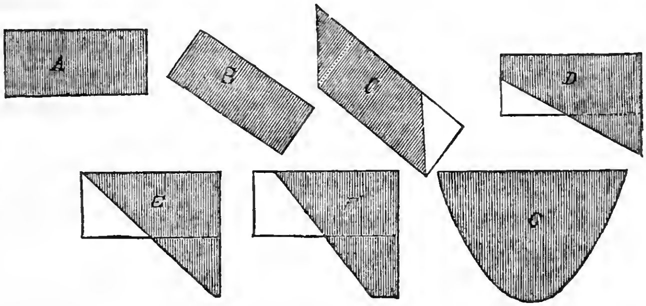
Long triangular paddles are figured on Etruscan vases; Isosceletic blades, blunted and truncated, may be seen on classic sculptures.

The figure is a South Sea paddle in my possession. It resembles several in Montfaucon. Charon is often represented with one akin to it.

By increasing the dip of paddles, the circles they describe are en-

larged, but in conical wheels that enlargement is confined to one side, while the width of the wheel and length of the shaft would be proportionably diminished. Such wheels could never be wholly raised out of the water by a vessel rolling. In the heaviest seas, they would have more or less hold of it.

Taking A for the position and proportions of a common paddle, what would be its comparative value if placed as at B; and when changed in its form, as at C, D, E, and F; and when doubled and the edges curved as F at G?



Where speed is everything, especially in vessels varying from 200 to 300 feet in length, instead of enlarging the present mammoth wheels, cannot a pair, if not more, of moderate sized ones be used to advantage at each side, as well as rows of oars in boats, and paddles in canoes? E.

A Simplified Form of the Mechanical Lamp. *By* M. Careau.

The lamp of French invention, in which the oil is raised to the wick by means of machinery, is well known in this country, under the names of "the Mechanical Lamp," "the Carcel Lamp," "the Diacon Lamp;" and to those who have used it, or seen it used, we need hardly say, that for brilliancy and steadiness of light, it has never yet been equalled. The greatest objection to it is its expensiveness, the plainest lamp costing (in this city) about $15.

M. Careau of Paris has already made several improvements, which have been favorably reported on to the Society for the Encouragement of National Industry—and from their Bulletin for October 1847, we copy the accompanying plate and description of his last simplifications, by which the price in Paris is reduced to 15 francs. ($3.)

We feel confident that if any of our ingenious Eastern friends were to take the trouble to get up patterns for a lamp of this kind, they would deserve the thanks of oil burners, and be enabled to furnish at a moderate price, a lamp, superior even to the excellent ones which we have now.

Description of the Figures. Plate III.

Fig. 4. Front elevation of the mechanism.

Fig. 5. Plan of the same. The same letter refers to the same part in both figures.

A. A plate forming one of the sides of the oil-box, to which is attached the pump B, of tin, composed of two parts, one placed on the other. Each of these parts is cast in one piece, and they are attached together by a screw at each corner.

C. The barrel whose teeth take into those of a pinion D, upon the shaft E.

G G. The eccentrics upon the shaft E; a part of the circumference is embraced by the forks H H, which form part of the levers I I, whose fulcrums are in the pillars J J.

K K. Piston rods—four in number, two to draw in the oil, and two to raise it; an annular space between the rods, and the openings through which they work, regulates the ascent of the liquid.

L L. Projections cast upon the pump, in which the valves are placed.

M. Plate fixed upon the pump, and carrying the ascension tube N.

Report on the Explosion of the Steamboat Edward Bates on the Mississippi River, August 12th, 1848, made to the St. Louis Association of Steamboat Engineers.

The undersigned, members composing the Standing Committee of the St. Louis Association of Steamboat Engineers, respectfully report, that in the discharge of the duties assigned them by the provisions of the sixteenth article of the Constitution of said Association, they went on board of the steamboat *Edward Bates*, on the 15th instant, for the purpose of examining into the cause of the recent catastrophe on board of said boat, and unanimously report the following as the result of said examination:

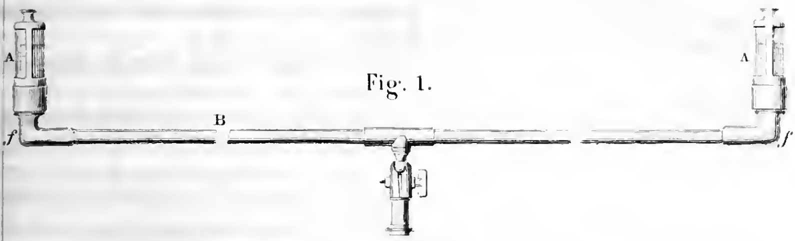
The *Edward Bates* has three double flue boilers, thirty feet in length, and forty-two inches in diameter; flues, sixteen inches in diameter, all made of iron one-fourth of an inch in thickness, and have been in use only since the first of March last. The iron is of a good quality, and the workmanship unquestionable.

The diameter of the safety valve is found to be three and eleven-sixteenth inches; the weight of the valve and lever is one hundred and thirty-two pounds; the pea hanging on the lever weighs one hundred and nine pounds, and was found attached to the lever at the distance of thirteen spaces or leverages, from the safety valve; and that the extra lead weight and wrenches attached to the safety-valve line, at the time of the catastrophe, weighed forty-two pounds, and were sixteen spaces or leverages from the safety-valve.

From the above data, it is ascertained that the weight on the safety valve was equal to a pressure of two hundred and six pounds to the square inch, without calculating the friction of the pulleys over which the line attached to the safety-valve was passed.

The Committee have been politely furnished with the written statements of Capt. Johnson, Wm. S. Belt, Clerk, I. C. Sitton, Pilot, and George G. Ambrose, Assistant Engineer, and also with the written statements of James W. Booth and Wm. Myers, passengers, the latter

Fig. 1.



Scale for Fig. 1. *Decimètres*

1 2 3 4 5 6 7 8 9 10

5 10

Fig. 5.

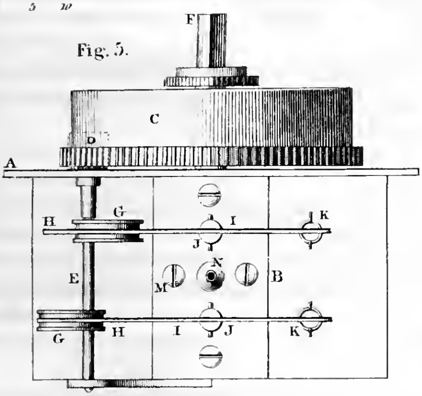


Fig. 2.

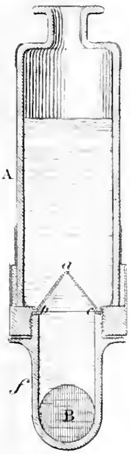
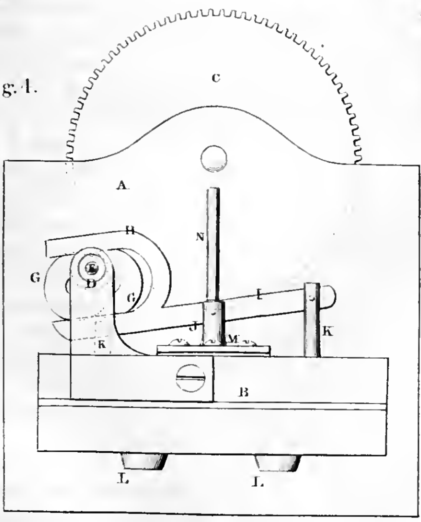


Fig. 3.

Fig. 4.



Scale for Figs. 4 & 5.

0 1 2 3 4 5 6 7 8 9 10 *Centimètres*

[illegible]

an engineer—all of whom were on board of the boat at the time of the catastrophe—copies of which are appended to this report.

From the above named statements it appears, that about 4 o'clock in the morning of Saturday, the 12th inst., when at the head of Westport shute, a short distance below Hamburg, both flues of the larboard boiler collapsed immediately. James Donahoe, chief engineer, and George C. Ambrose, assistant, being on duty at the time. That at the time of the explosion the fires were full; the fire doors and flue caps closed; the doctor and pumps stopped, and a weight on the safety valve equal to a pressure of two hundred and six pounds to the square inch.

It also appears that, for the last nine miles, the two engines had been worked slow and fast alternately; that steam had been blowing off occasionally while running slow; that the Engineer told the firemen to shove up the fires, and that the safety-valve was shut down twice within a few minutes previous to the explosion, and that "*the last time he shut it down the accident happened*," to use the language of the assistant.

From a particular examination of the flues, after the collapse, it appears that the rivets, where the sides have been forced together, in several places, have made indentations plainly discernible on the outsides of the flues, from which fact, as well as from the peculiar shapes into which the flues are warped and twisted, it is plainly indicated that a portion of the flues were red hot at the time of the explosion.

From all these circumstances, the undersigned have come to the conclusion unanimously that the disaster was caused by the water being too low in the boiler, and by the unusual head of steam accumulated by overloading the safety valve, increasing the fires, and shutting off the supply of water from the pumps; and *that these causes are to be attributed to the recklessness, or imprudent management of the Chief Engineer on duty, James Donahoe.*

While the committee consider it their sacred duty to shield from unjust censure any member of the Association, yet it is equally their duty to bestow censure where it properly belongs. This duty they owe to themselves individually, to the Association which has made them its agents, and to the community of which they form a part. This is the first occasion since the organization of this Association in 1842, that any serious disaster has occurred to any boilers in the charge of any of our members, and the circumstances are such as demand of the Association their most serious attention, and call for the adoption, in this case, of such measures as will effectually carry out the objects of the Association, and prevent the future occurrence of similar catastrophes.

In concluding this report, it may be proper to state that the portion of the statement of George G. Ambrose, in relation to the *fire doors or flue caps being open all the time while running through the shute,* was given as his belief or impression—but when questioned as to the means by which he obtained such belief or impression, it was ascertained that he had no means of knowing whether they were open or shut.

The time that elapsed between the moment the doctor was stopped and the explosion, is stated by the only witness who was aware of the fact, to be about one minute. This may be true, and if so it only goes to prove that the best boilers cannot be trusted even that short period of time without a proper supply of water to keep the flues covered, and preserve them from the action of the fires beneath.

If the boat was "in the habit of rolling very much," as represented by the assistant engineer, then it would have been the duty of an engineer to have closely watched the water in the outer boilers, and if he found it scant, he should not have had such heavy fires as were evidently under these boilers at the time of the collapse.

The pilot and assistant engineer express the opinion that the boat was trim at the time of the explosion, but the position of the flues as found by your committee does not corroborate this statement. The committee found the collapsed flues lying in an oblique position, with their tops leaning to the larboard side, and their bottoms to the starboard side of the boiler, thus clearly indicating by their position, in the minds of your committee, that the boat was careened to the starboard when the explosion took place.

This Association has repeatedly asked of Congress the passage of a law restricting engineers to the amount of pressure that should be carried on boilers on board of steamboats, but have thus far failed to effect so desirable an object. Had a law of this kind been passed, with proper and adequate penalties, the design of the Association could have been fully carried out, and thereby have amply secured to those traveling on our western waters, their lives and property. The committee having discharged the duty assigned to them, by an investigation of the facts presented to them, leave the matter to the final disposition of the Association, with the firm assurance that they will do all that the moral force of their action can effect in the premises.

Very respectfully,

James H. McCord,
Peter Vandervort,
Andrew Boswell,
A. S. Halstead,
Wm. W. Denson.

St. Louis, Aug. 17, 1848.

Statement of W. C. Johnson, Commander of Steamboat Edward Bates, Aug. 14, 1848.

The boat landed at Cap au Gris about two o'clock on the morning of the 12th Aug., and discharged about two tons of freight. Having no landings to make before we reached Hamburgh, a distance of twenty miles, I retired, leaving the first engineer, pilot, and watchman on duty. Up to this time, from every appearance, she carried no more than the usual quantity of steam. At four o'clock, I was awakened by the explosion or the cry of fire. On going below, I found that the flues of the larboard boiler had collapsed, fore and aft. Any information of the facts with regard to the explosion which I may have, are from the officers on watch and the passengers who were up

at the time. The accident occurred at the head of Westport shute. The boat had been running over shoal water for nine or ten miles previously.

Statement of W. S. Belt, Clerk.

I was awake for some time previous to the accident and thought there was an unusually loud escapement of steam from the safety valve, although I did not think of danger at the time. The escapement of steam, from the noise made, seemed to increase every moment, till the collapse took place. As to the gauge cocks being tried, I could not say, as it was impossible from the noise made by escapement of steam immediately under me, to hear it, as it drowned all other noise on the boat to my hearing.

Statement of Wm. Myers, Passenger.

I was in bed at the time of the explosion, which wakened me very suddenly; got up and went below as quickly as possible; discovered the blaze from the fires standing out between the boilers; fires were full of wood at this time ; fire doors and flue caps that were remaining all shut up: began to throw water on the fires, and continued at that until the blaze was stopped from between the boilers, and then went to safety valve lines, and found the lead weight hanging on the valve lines, and believe that there were two wrenches lying there likewise.

Statement of Isaac C. Sitton, Pilot.

Came on watch at 12 o'clock, as also did Mr. J. Donahoe, first engineer. In going through Westport shute, we worked both engines, slow and fast alternately, which was a distance of nine miles; she was blowing off occasionally while running slow ; heard the water tried and it sounded as though it was flush ; don't know upon which side, or whether more than one gauge cock was tried or not. I think she was trim when the explosion took place ; do not think that there was any more steam carried this trip than on any previous trip; in running the last quarter of a mile I heard the engineer shut the valve down twice, and still kept blowing off until the explosion took place. Some few minutes before the explosion took place, heard the engineer tell the fireman to shove up the fires.

Statement of Geo. G. Ambrose, Assistant Engineer.

I came on watch with Mr. Donahoe at 12 o'clock, some ten or twelve miles below Cap au Gris ; we had no difficulty at all in keeping water in the boilers; when in Westport shute water in the boilers flush in the upper gauge cocks, and doctor running, and about an ordinary head of steam ; the doctor was not stopped more than a minute; all the time in running through the shute the fire doors were open, and flue caps also ; from the time she commenced working slow, steam was blowing off, which was a distance of eight or ten miles ; Mr. Donahoe shut the safety valve two or three times, and the last time he shut it down the accident happened ; at the time of the occurrence there was less weight on the valve lines than was usually carried ;

tried the water and found it flush, and stopped the doctor, and did not try the water afterwards; it was not more than one minute from the time the doctor was stopped until the explosion took place; don't know exactly but think that Mr. Donahoe had hold of the safety valve lines at the time of the explosion; the boat was in the habit of rolling very much.

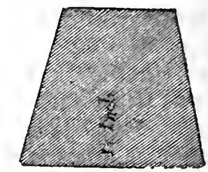
Statement of James M. Booth, Passenger.

Was up at the time of the explosion of the boilers of the steamer Edward Bates; thought the steam high at the time; the boat running slow at the time of making the crossing just below Hamburg, Ill., the explosion took place about 4 o'clock on the morning of the 12th, and heard the steam escaping; think I heard two gauge cocks tried once, or one tried twice; was of the impression the engineer was on duty and at his post; immediately after reaching the banister on the boiler deck, larboard side, the explosion occurred; am not a competent judge whether there was water enough in the boiler at the time the gauge cocks were tried or not. St. Louis Daily Union.

Statement of Experiments made on the Relative Strength of Cast Iron, Chilled and Unchilled, at Crane Foundry, on July 21, *and August* 23, 1847.

I. *Experiments of July* 21.

The bars upon which the experiments were made were two in number, and were run at the same time from the same pot of metal. One of the bars was cast in the ordinary method of green sand-casting, and of the following dimensions:—Width of top edge, ½ an inch; width of bottom edge, 1 inch; depth, 1½ inch; total length, 4 feet; width between the supports when proved, 3 feet 10 inches; area of cross section, 1·125 inch; weight, 13½ lbs.



The chilled bar had exactly similar dimensions to the above: except that the width of the bottom edge was $\frac{15}{16}$ths of an inch only, instead of 1 inch, this difference arising from the sudden cooling of the bottom edge, which was run upon a piece of cold iron in order to chill it; (the bottom edge being the only part chilled;) in consequence the area of the cross section was only 1·078, instead of 1·125, and the weight was 12 lbs. 13 oz., instead of 13½ lbs.

As the chilled and unchilled bars are of different areas, and consequently of different strengths, it will be necessary before comparing them, in order to find the results produced by chilling, to reduce the weights they are capable of bearing to the standard of one or other of their areas. It will be most convenient to reduce the area of the unchilled bar to that of the chilled bar: and since solid cast iron beams will carry nearly in proportion to their cross sections, every thing else being the same, the strength of an unchilled bar of the same area as the chilled bar, will be found as follows:—As the area of the large unchilled bar, 1·125 inch, is to the area of the smaller chilled bar, 1·078

inch, so is 6·28 cwt., the weight borne by the large unchilled bar, to 6·01 cwt., the weight which would have been borne by an unchilled bar of the same area as the chilled bar. But by the process of chilling, the small bar was made capable of bearing a weight of cwt. 7 035, instead of cwt. 6·01, the weight it would have borne had it not been chilled; and in consequence it results, that the process of chilling the under edge of the bar gives a superior strength of 17 per cent. on the cross section.

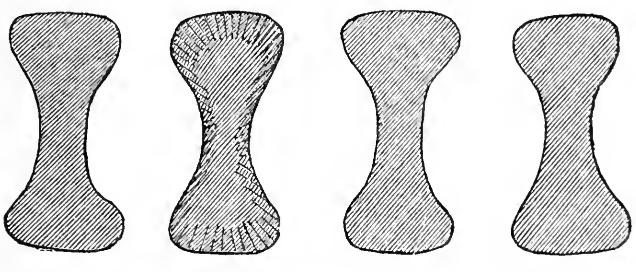
Number of Experiments.	Load carried by the bar.			Deflection observed in decimal parts of an inch.		Chilled bar deflects more than unchilled by difference as under.	Remarks.
	cwt.	qr.	lbs.	Unchilled bar.	Chilled bar.		
1	. .	3	4	·0000	·0000	·0000	All weights taken off, bars resumed their original position.
2	1	3	4	·0000	·0625	·0625	
3	2	3	4	·0625	·1250	·0625	
4	3	3	4	·1250	·2187	·0937	
5	4	3	4	·2500	·3125	·0625	
6	5	1	4	·2969	·3437	·0468	
7	5	3	4	·3125	·4060	·0935	
8	6	1	4	·3437	·4687	·1250	
9	6	2	4	Broke.	·5321		3 ins. from centre.
10	7	0	4		·5321		
11	7	1	4		Broke.		¾ of an inch from the centre.

II. *Experiments of August* 23.

The bars upon which these experiments were made, were all cast from the same pot of metal, and at the same time; they were four in number; viz: No. 1, cast in green sand; No. 2, in dry sand; No. 3, cast in a *chill;* No. 4, cast in a *chill,* and afterwards annealed.

The total length of each bar was 18 inches, and the distance between the supports in each case 15 inches.

No. 1. No. 2. No. 3. No. 4.



The figures above represent the sections of the bars, full size, as nearly as they could be taken.

With regard to the formation of Table No. 1, there will be no remark necessary, as it explains itself, excepting merely to observe that it appears from it, that green sand castings are 6 per cent better than dry sand, and 30½ per cent. better than chilled ones without annealing; and, lastly, that by the process of chilling and annealing, 115 per cent. is added to the strength of cast iron in respect of ability to resist impact.

Table No. 1.

Col. 1	Col. 2.	Col. 3	Col. 4.	Col. 5.	Col. 6.	Col. 7.	Col. 8.	Col. 9.	Col. 10
Number of bar.	Weight of bar.	Area of section.	Weight, if reduced to same area as bar No. 1, ·46 in.; col. 3, col. 2, col. 4.	Densities of bars, taking bar No. 1 as standard, 32·5 is to col. 4 as 100, col. 5.	Weight actually borne by each bar.	Weight each would have borne, if reduced to area of No. 1, ·468 as col. 3, col. 6, col. 7.	Last column reduced to standard of 100, to show per centage.	Observed deflection or measure of elasticity.	Reduced to standard of 100.
	Ounces.	Inches	Ounces.	—	Lbs.	Lbs.	—	Inches.	—
1	32.50	·468	32 5	100 0	1232	1232	100·0	·130	100
2	30·50	·407	35·0	107·3	1008	1159	94 0	·114	87
3	34·75	·423	37·9	116·7	784	857	69·5	·053	40
4	34·50	·444	36·3	111·7	2520	2656	215·0	·148	114

Although from the smallness of the bars experimented upon, and their bad section for comparison with the experiments of others, yet the above are quite sufficient to show the vast superiority of cast iron treated in the manner described for No. 4, and the advantage resulting may safely be looked upon as very little less than 100 per cent.

It may also be well to observe, that these experiments show that the density of cast iron is by no means a criterion of its strength.

With regard to the table of experiments, the method adopted in order accurately to measure the deflection, was by having a cord from the bar under trial passed over and secured to a brass drum, exactly 4 inches in circumference; from the centre of the drum axle a large circle was described, the quadrant of which was divided into hundredths, and a pointer, fixed on the drum, consequently indicated with great nicety the most trifling deflection.

It may also be remarked that column 5 is the comparison of the deflection of bar No. 4 with Nos. 1 and 2 only: No. 3 not being a sample of common casting, and therefore not included in the average.

With regard to the microscopic appearance of the sections, No. 1 presents much the same appearance at the top as at the bottom of the section, excepting that in the lower part the fracture of the iron seems more open, but nothing like a crushed appearance is observed towards the top. The fracture in this bar is about ¼ of an inch from the centre, and goes through nearly in a straight line, and at right angles with the horizontal line.

No. 2.—With regard to this bar, exactly the same remarks apply to it as in the case of No. 1, excepting that the fracture took place in the centre between the ends of the bar.

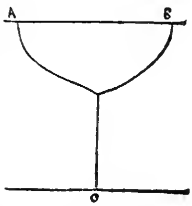
No. 3.—The fracture of this bar presents a very singular appearance;

it is highly crystallized, and the granular structure, instead of being homogeneous, as in the former cases, appears to be made of crystallized threads, radiating from the centre of the curves which form the profile of the section. An attempt to represent this appearance has been made in the engraving of this section (No. 3.) It broke with a straight fracture ⅜ths of an inch from the centre of the bar, and about ¼ of an inch out of the perpendicular line in the width of the bar.

Table No. 2.

Col. 1.	Col. 2.			Col. 3.				Col. 4.	Col. 5.	
Number of Experiments.	Load carried by bars.			Deflections observed in decimal parts of an inch.				Average deflection of Nos. 1 and 2.	Inferior deflection of No. 4, with same weight.	Remarks.
	cwt.	qr.	lbs	No. 1.	No. 2.	No. 3.	No. 4.			
1	1	0	0	·0000	·0000	·0000	·0000	·0000	·0000	
2	2	0	0	·0200	·0200	·0050	·0100	·0200	·0100	
3	3	0	0	·0350	·0350	·0175	0225	·0200	·0130	
4	4	0	0	·0500	·0525	·0236	·0365	·0350	·0150	
5	5	0	0	·0650	·0750	·0370	·0535	·0510	0160	
6	6	0	0	·0775	·0875	·0420	·0650	·0700	·0170	
7	7	0	0	·0900	·0975	·0530	·0665	·0820	·0270	
8	8	0	0	·1025	·1084	Broke.	·0680	·0930	·0370	
9	9	0	0	1125	·1140		·0750	·1050	0380	
10	10	0	0	·1213	Broke.		·0800	·1130	·0410	
11	11	0	0	·1300			·0870	·1210	·0430	
12	11	2	0	Broke.			·0900	·1300		
13	12	0	0				9500			
14	12	2	0				·1000			
15	13	0	0				·1050			
16	13	2	0				·1100			
17	14	0	0				·1150			
18	14	2	0				·1200			
19	15	0	0				·1285			
20	16	0	0				·1325			
21	17	0	0				·140 *			* Weight removed, and bar resumed its horizontal line.
22	18	0	0				·1200†			
23	19	0	0				·1250			
24	20	0	0				·1300			
25	21	0	0				·1410			† Weight put on again, and deflections presented.
26	22	0	0				·1475			
27	22	2	0				·1480			
28							Broke.			

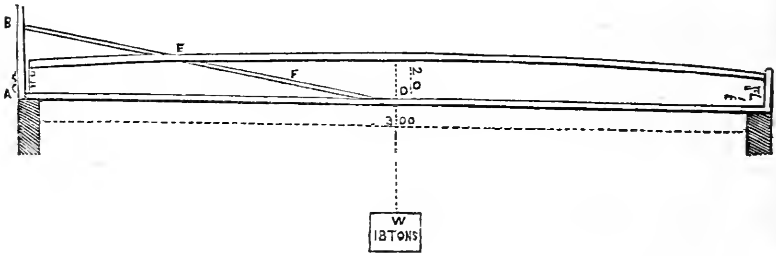
No. 4.—At the moment of fracture this bar broke in two places; the one a simple fracture about 5 inches from the end, and nearly at right angles to the plane of the bar, and the other a compound fracture, about ¼ of an inch from the centre, and represented in the adjoining figure, A B C representing the line of centre fracture. The iron had completely lost the crystallized appearance of No. 3, and had resumed the granular structure of Nos. 1 and 2, excepting that the grains are much finer and look more like the fracture of cast steel than cast iron.



Lond. Mec. Mag. Nov. 1847. ROBERT BOWMAN.

Extract from some Experiments upon Girders and Tensile Rods.

The annexed figure is an elevation of a large cast iron girder or beam, at the end of which is shown a piece of wood, AC, securely fixed. EF is a stout rod, (representing the position of the tensile bar,) one end turning on a centre, B, and the other end resting on a block, D, fastened to the bottom flange of the girder, at equal distance from the bearings.



The object of this experiment was to show, on applying the weight, W, how much the distance, BD, increased, or, in other words, to what extent a tension bar, fixed at the points, BD, would be stretched.

The variation in the distance, BD, was taken by a vernier, one scale of which was affixed to the block, D, the other to the rod, EF. The height of the point, B, above A, (or the bottom of the beam,) was varied in the experiment.

The weight, or load, was applied by means of hydraulic pressure, and the deflection with 18 tons was $\frac{6}{10}$ths of an inch.

When the height of the point, B, above A, was 1 foot $5\frac{1}{2}$ inches, the distance, BD, increased ·038 in.

When the height of the point, B, above A, was 2 feet, the distance, BD, increased 0·217 in.

When the height of the point, B, above A, was 3 feet, the distance, BD, increased ·0064 in.

A similar experiment was made with a cast iron beam of different dimensions; the particulars and details are as follow:

Length of bearings, 24 feet 10 inches.

Depth of beam in middle, 1 foot $4\frac{1}{2}$ inches.

Ditto at ends, $7\frac{1}{4}$ inches.

The weight applied to the middle was 12 tons, the deflection $\frac{7}{10}$ths of an inch.

When the height of the point, B, above A, was $\frac{1}{2}$ inch, the distance, BD, increased ·0382 in.

When the height of the point, B, above A, was 10 inches, the distance, BD, increased ·013 in.

When the height of the point, B, above A, was 1 foot 8 inches, the distance, BD, *decreased* ·0145 in.

When the height of the point, B, above A, was 2 feet 6 inches, the distance, BD, *decreased* ·034 in. Ibid. Dec. 1847.

Chemical Action arrested by Mechanical Vibration.

A slip of iron, ¼ of an inch in diameter, was suspended perpendicularly by one end with a strong packthread, and, while so, a vessel of nitric acid was brought underneath it, and then raised so as to allow the lower end of the iron to dip into it. On this being done, energetic action took place, which was immediately suspended on giving the top end of the slip a smart blow in a perpendicular direction with a hammer. The iron was then let down in the acid, and remained perfectly inactive during two days. It also communicated inactivity to other pieces that were brought into contact with it. This experiment was subsequently varied, with, if possible, more interesting results.—A wire, like the one formerly used, was suspended in the same manner, but the packthread was now held in the hand; it was then struck at the lower end obliquely with a piece of iron, to cause it to ring, and while so, it was introduced into the acid. No action took place on immersion, but the instant the end of the iron came into contact with the side of the vessel, which had the effect of breaking the vibration, action proceeded most energetically, which, on being instantly removed to the centre, partially ceased; then went on, although less partially; but it was quite evident that, as the effects of the vibration became weaker, the action of the acid on the iron increased. Should it be immersed while under the effects of a slight ringing blow, the action is beautifully illustrative of molecular vibration, bubbles of gas being given off the surface of the iron in intermittent waves. Sometimes this is produced in a slip that has been often used, by a smart perpendicular blow at the bottom of the vessel containing the acid.—A structural alteration throughout the molecules of iron, has been long supposed to take place by some, and ridiculed as fanciful by others. This want of unity of opinion has sufficiently prevailed to prevent the fact from entering into practical consideration with regard to engineering matters.—*Mr. Spencer.*—*Liverpool Mercury.* Ibid.

The Wave Principle in Ship Building.

Mr. Scott Russell gave a lecture at the Royal Institution on the 2d instant, on the new principle introduced by him into ship building, called the Wave Principle. We extract the following abstract of it from the Athenæum. Mr. Russell's object was—first, to explain his theory of naval construction; secondly, to connect with that theory practical rules for the construction of ships; and, finally, to state the results which have followed the adoption of the form resulting from this principle,—by the general adoption of which the velocity of merchant steam ships have, within twelve or fifteen years, been raised from an average of nine or ten miles to an already achieved speed of seventeen or eighteen miles an hour. The theory is derived from the observed properties of what Mr. Scott Russell has termed *the solitary wave of translation,* (or the wave of the first order,) and those of the *gregarious wave of oscillation,* (the wave of the second order.) The

first named wave moves with a velocity which can neither be accelerated nor retarded by the velocity of the floating body which produces it; while the latter does depend on the speed of the boat by which it is caused. The solitary wave is formed by the bow of a ship when in motion, and its velocity depends on the curve of the water line of the vessel. Mr. Scott Russell proceeded to connect with these properties of the waves he described, the following principles of naval architecture:—1. The principle of removing the least quantity of water to the least distance. Assuming that all horizontal motion through a fluid implies the displacement of that fluid, it is obvious that the amount of moving power required to propel a vessel will vary with the bulk of water disturbed, and the range of its disturbance. In the ordinary construction, a great mass of water is set in motion on either side of the bows of the ship; but, as Mr. Scott Russell had proved experimentally in the wave boats, no more water was disturbed by them than was occupied by the immersed portion of the vessel. 2. The principle of adapting the form of the body which is to disturb the water to the natural form of the fluid which is to be disturbed. Referring to the properties of the wave of translation, Mr. Scott Russell proved that it was impossible to propel any vessel with a speed greater than that of the wave of the first order, which it produced by its motion; and that, therefore, wherever speed was required, the shape of of the vessel must be modified to accord with laws of that wave.—Thus, the length of fast ships must be great, (200 feet of keel being requisite to insure, with least power, a speed of 18 miles an hour, 300 feet of keel to attain 23 miles, &c.) On the same principle, boats made on the wave principle are broadest abaft the middle; the lines of run are much finer in the bow than at the stern, the bow portion of the water line being concave. 3. The principle of allowing the replacement of water to take place with the greatest possible velocity. The wave formed by the after part of a ship is not the wave of translation, but the oscillating wave of the second order. It arises from a vertical motion of the water from below to replace the hollow left behind the ship as it passes onwards. This replacement is most rapid when the stern portion of the water line is full. Mr. Scott Russell mentioned that vessels of various kinds, which had been built on the principles he described, (although the principles themselves were not understood by those who acted on them,) had always been remarkable for speed. The old Thames wherry, the smugglers' boats, privateers, the caique of the Bosphorus, fishing boats in the North of Scotland, have been built more or less on this principle; and it was remarkable that whenever the form of any of these vessels was changed, with a view to improvement, the speed was always diminished. But the most important test of the wave principle of construction, is afforded in the Holyhead fast boats,—all of which had systematically been constructed, with more or less accuracy, in conformity with the wave principle, and are propelled at the rate of from 17½ to 18½ miles an hour; the rapidity being the greatest in those boats in whose construction this principle is most accurately maintained. By the same principle, he felt satisfied that 23 miles an hour could be produced; and he was quite prepared to carry that speed practically into effect. **Ibid. July, 1848.**

Decomposition of Light by the Eye.

On closing the eyes, after having looked steadfastly at a sheet of white paper held in the sun for about half a minute, and covering them without pressure, to exclude extraneous light, (a silk handkerchief held in the hand will answer the purpose,) the figure of the paper remains visible for some time. At first it is generally white, and then gradually changes through the colors of the spectrum. All the colors are seldom seen at the same trial; and it rarely happens, when one or more are missed, that they afterwards appear. Thus, when the change is from green to red, yellow or orange are seldom seen. The change from white generally commences with a light indigo or blue, and terminates with red, or some compound of it,—but sometimes with a deep blue or violet. The colors are generally seen at the edges of the figure first,—though this is not always the case; and when they once appear, they often remain mixed up with those that succeed.—Many curious modifications and confused mixtures of colors will be perceived at times; but it seldom happens that the colors develope themselves, in the first instance, contrary to their order in the spectrum, although when the last has appeared they occur in various ways.—This is a phenomenon which I have not seen noticed anywhere; and it would seem to arise from the retina decomposing the light that falls upon it, surrendering the rays in the order of refrangibility.

London Athenæum, July, 1848.

F. C. Bakewell's Copying Telegraph.

We have this week seen a specimen of writing by the copying telegraph invented by Mr. F. C. Bakewell; wherein words traced from the original were legibly copied on paper, by an instrument that had no connexion with the one to which the transmitted message was applied, excepting by the usual wires from the voltaic battery. The letters traced on the paper appear of a pale color, on a dark ground formed by numerous lines drawn close together. The communications thus traced, we understand, may be transmitted at the rate of five hundred letters of the alphabet per minute of ordinary writing; and were short-hand symbols employed, the rapidity of transmission would be quadrupled. When this means of correspondence is in operation, instead of dropping a letter in the post-office box, and waiting days for an answer, we may apply directly to the copying telegraph, have it copied at the distant town in a minute or less, and receive a reply in our correspondent's handwriting, almost as soon as the ink is dry with which it was penned. There are various means, too, for preserving the secrecy of correspondence; the most curious of which is, that the writing may be rendered nearly invisible in all parts but the direction, until its delivery to the person for whom it is designed. The operations of the copying telegraph are not limited to the tracing of written characters. Letter press printing may be copied with even greater

rapidity than writing, and fac-simile copies of the morning papers may thus be transmitted to Liverpool and Manchester long before the papers themselves are delivered to their readers in London. The means by which these astonishing effects are produced, we are not at present permitted to state, as the invention is not yet protected; but we are assured that the method is simple, and that the mechanism is neither costly nor likely to get out of order. It is, indeed, one of the peculiar features of the copying telegraph that it cannot commit errors, because the communications it transmits are fac similes of the original writing. —*Spectator.* **Ibid., May, 1848.**

School of Chemistry.

We see with pleasure that a School of Chemistry has been established in Liverpool—under the superintendence of Dr. Muspratt, who was formerly Assistant Professor in the College of Chemistry in London. The spread of such institutions is a wholesome educational sign —and we hope ere long to see a school for analytical instruction founded in every great town in the kingdom. That in a country like ours this should not long since have been the case, is one of the abundant instances, now coming to the light of improved views in the matter of education, of the manner in which the national resources have been wasted. Chemistry must in future be part of all liberal—as it should be of nearly all operative—education. All the substances with which the workman deals and all the manufactures in which he is engaged contain important secrets to be yielded up to the practical chemist. The most valuable economic truths now to be discovered lie probably in that direction. It is well observed in the prospectus of this Liverpool Institution, that popular lectures on chemistry, however useful in their way, serve only to give a taste for science; they never teach it. "It can be taught only in schools where the student has to work with head and hands, under the eye of a professor." Why have not great towns like Manchester universities of their own—where practical rather than speculative knowledge may be taught—the lore of the Future may replace the lore of the Past, which has so long been held as the proper object of education—and the means may be elementarily inculcated of developing the great industrial resources of a country where population is pressing on them in a yearly increasing ratio? **Ibid., July, 1848.**

The Lackawanna and Wyoming Coal Region.

It is somewhat extraordinary that the Anthracite Coal Fields of the Lackawanna Valley, yielding this valuable mineral to an extent probably exceeded by that of no other mines within the bounds of the United States, have not attracted to a greater degree the capital and enterprise of the country. Situated at a distance from the city of New York which can be traveled in a single day, and in a region abound-

ing with the purest air, it presents at the present time uncommon advantages for the mining and transportation of this product. Although its vast resources yet remain but partially developed, a beginning has been made in this important branch of the mining interest. Besides extensive beds of coal, it also contains mines of iron, which have been in some degree improved. A railroad extending from Carbondale to Honesdale, through a distance of sixteen miles, and a canal running from that point to Roundout, upon the Hudson River, which have been constructed by the Delaware and Hudson Canal Company, a company which has for the last few years made an annual dividend of 20 per cent., afford a convenient avenue of transportation to the city of New York, through which it is annually transported to the amount of about three hundred thousand tons, from the mines to the Hudson. There are also other important works of internal improvement in this region which will constitute prominent channels of transportation in the enterprise that will soon be exerted in the development of its resources. A railroad has been finished by the same company for the distance of eight miles, from Carbondale to White Oak Run, penetrating some of the most interesting parts of the coal region, abounding in water power, iron ore, and valuable timber. There are other parts of this region which deserve consideration. The construction of a line of public works, which might constitute an avenue for the transportation of the rich mineral products of this part of the valley of the Susquehanna, and its adjacent territory, within the bounds of Pennsylvania, to convenient markets, was one of the earliest plans of improvement entertained by the enterprise of the Atlantic States. The Chenango and Chemung Canals are known to have been completed for the purpose of reaching the extensive beds of coal and mines of iron in that State, and the North Branch Canal was commenced, on its part, to meet the advances of New York, and to intersect one or both of those works. The canal to which we last alluded was prosecuted with great industry from the year 1836 to 1841. During the month of May of the latter year, a suspension of all the public works upon the unfinished lines of internal improvement was ordered by Pennsylvania, and at that time there had been expended upon what is denominated "the North Branch Extension," the sum of two millions four hundred and eighty-four thousand nine hundred and thirty-nine dollars and sixty cents. During the next session of the Legislature, a law was passed authorising the incorporation of a company for the purpose of finishing that portion of the line extending from the mouth of Lackawanna Creek to the northern boundary of the State, and thirteen miles of what was termed the "Wyoming Line," running from the Lackawanna down to the mouth of Solomon's Creek, which had cost the State five hundred and fifty thousand dollars, were added to "the North Branch Extension," all of which was proposed, under certain conditions, to be yielded up by the State.

In consequence of its inability to borrow the sum necessary to complete the work, upon which more than three millions of dollars had already been paid, the State now agreed to relinquish the work to the

enterprise of a company, for the period of forty years, upon condition that a little more than a million of dollars should be expended in its completion. On that part of the line reaching from the Lackawanna to the northern boundary of Pennsylvania, a distance of more than ninety-four miles, detached sections, amounting to a little more than thirty-two miles, have been completed, and more or less work has been done upon the remaining portion. There is another important consideration connected with this work, which is, that nearly all the lands to be occupied have been leased for the use and occupation of a canal, to be constructed by or under the authority of the State of Pennsylvania. The connexion of the North Branch Canal with the Chemung Canal of New York, at Elmira, will complete the line of inland navigation from tide-water to the great lakes.

The tonnage upon which the canal must depend for its revenue will be chiefly derived from the mineral products of the region stretching along its border. It will consist of anthracite and bituminous coal, iron, gypsum, salt, lime, and limestone. But although these products will doubtless constitute the greater portion of its freights, there will be a considerable amount realized from the transportation of sawed lumber, shingles, staves, and heading, merchandise, agricultural productions, as well as that which is derived from miscellaneous articles.

A prominent, and, we may add, a principal staple of exportation by the canal and its connecting works, would be derived from the rich coal beds of the Wyoming valley. The resources of the Wyoming coal region in that useful product are not generally known. It is believed, from a pretty full examination, that in the thickness of the beds, the quality of the coal, and the facilities for mining and shipping it upon the canal, this interesting valley abounds in that mineral, and possesses advantages for mining to an equal if not to a greater extent than any other part of the State of Pennsylvania. In evidence of this fact, it may be stated that a large amount of Wyoming coal is now exported more than two hundred miles to tide-water, and, in the markets of the Atlantic cities, enters into successful competition with coal carried from other regions but half that distance from the sea-board. By the terms of their charter, the North Branch Canal Company possess the exclusive right to the transportation of the valley of the Susquehanna, and in consequence no such rivalry as now exists in the exportation of this mineral throughout the valley of the Schuylkill can exist. If, by opening an avenue for the exportation of coal from this region northward, a market can be found for two hundred thousand tons of coal, there is in that amount a sure tonnage in this one article equal to the production of eight per cent. upon the capital which is necessary to complete the work. It is not doubted that by the North Branch Canal, Wyoming coal could be delivered upon Lake Ontario for less than five dollars a ton.

The increasing consumption of coal in the United States is a fact which should not be disregarded in considering the importance of this region. We are informed that throughout Western New York, and the populous region bordering the great lakes, anthracite coal is but

little used, excepting in carrying on a few branches of manufactures. Its use is applied to an increasing number of objects, and it is alleged that a vast amount would be consumed in the manufacture of salt, in iron foundries, and other species of manufactures, as well as for domestic purposes throughout the country bordering the great lakes west of Utica; without estimating the amount to be shipped at Oswego and Buffalo for the markets on the lakes and in Canada, and for the use of steamboats. The anthracite coal of Pennsylvania is now employed in steamboats which navigate the St. Lawrence, to which point it is brought by sea from New York, and is used with advantage one hundred miles north of the city of St. Louis. At Syracuse and other salt villages a very large amount is likewise consumed. There is at present no avenue by which the region bordering the lakes can be directly supplied; but when the North Branch Canal is completed, the country west of Utica can be provided with this product, and we are told that Pennsylvania anthracite can be delivered at Buffalo for about five dollars and fifty cents per ton, at Oswego upon Lake Ontario for five dollars, and in other places at proportionate prices. The coal field of Bradford county, lying upon the north-eastern verge of the bituminous coal region of Pennsylvania, and within twenty-five miles of the State of New York, occupies an area of about one hundred and fifty square miles, producing bituminous coal of the best quality; and it is somewhat extraordinary that this tract of territory, containing such abundant resources, should have been so greatly neglected by the active capital of the country. It is stated that not less than five hundred thousand tons of coal would annually find a ready sale in the country bordering the lakes. Subjoined is a statement, showing the distances from the mines below Lackawanna, to various points in the State of New York, where markets will be found for anthracite; as also the estimated nett value of a ton of coal delivered at these several points:—

From Coal	Mines to	State Line,	100	miles,	\$2·55	value of coal per ton.
"	"	Elmira,	117	"	2·77	"
"	"	Seneca lake,	140	"	3·00	"
"	"	Geneva,	185	"	3·45	"
"	"	Montezuma	206	"	3·66	"
"	"	Palmyra,	241	"	4.00	"
"	"	Rochester,	270	"	4·30	"
"	"	Lockport,	334	"	4·94	"
"	"	Buffalo,	365	"	5·25	"
"	"	Syracuse,	240	"	*4·00	"
"	"	Oswego,	278	"	4·38	"
"	"	Rome,	286	"	4·46	"
"	"	Utica,	301	"	4·61	"
"	"	Little Falls,	323	"	4·83	"
"	"	Schenectady	381	"	5·41	"
"	"	Albany,	411	"	5·71	"

* Coal used in manufacturing salt would go free of toll from Elmira to Syracuse; and the cost for that object would be \$3·75 per ton.

The coal trade is beginning to constitute a very important part of active enterprise in the United States. The south anthracite coal field, the middle and the Wyoming beds of Pennsylvania, it is well known, pour down upon the Atlantic cities a large amount; and with the decrease of the forests, and the new application of that product to various manufacturing purposes, the amount is annually augmenting. We subjoin a table of the amount of its consumption within the last twenty-seven years:—

A Tabular Statement, showing the Increased Consumption of Anthracite Coal, from its First Introduction to the year 1847.

Years.	Tons.	Years.	Tons.	Years.	Tons.
1820	365	1829	112,082	1838	739,290
1821	1,073	1830	174,734	1839	819,327
1822	2,240	1831	176,820	1840	865,414
1823	5,823	1832	363,871	1841	842,244
1824	9,541	1833	437,648	1842	1,108,000
1825	34,893	1834	376,636	1843	1,268,852
1826	48,047	1835	560,658	1844	1,627,588
1827	63,434	1836	682,428	1845	2,012,742
1828	77,516	1837	881,476	1846	2,338,560

Without entering into a particular consideration of the amount of iron, salt, plaster, and lumber, which would add to the transportation of the North Branch Canal, it is evident that the sale of Pennsylvania iron would be largely increased by its completion. The bar and pig iron of the Susquehanna valley could then be carried to Buffalo at a less price than it now costs at that place when brought a distance of three hundred miles from Lake Champlain. All the country in the State of New York lying between the Susquehanna and Lake Erie could also be supplied with this useful product; and as there is no duty charged upon American iron in the Canadas, it might be exported even to those markets. It is indeed computed, from a well-accredited source, that not less than four hundred thousand tons of Pennsylvania iron would find an annual outlet through the North Branch route; the boats carrying coal and iron into that region would bring back salt, plaster, and water lime; and the country lying near the banks of the Susquehanna would derive their supplies of those products from the State of New York through the Susquehanna and North Branch improvements. Another source of prosperity to the work would be the transportation of lumber from the northern counties of the State, sixty millions of feet of which now annually descend the Susquehanna.

An important feature of the works of the North Branch Canal Company, which will extend about one hundred and seven miles, is, that it will complete a continuous line of transportation extending from the coal fields of Wyoming, to Philadelphia, New York, Baltimore, and also the west. By their completion, the products of this region, now comparatively shut out from convenient markets, will find their way through various lines of communication not only to the shores of the lakes, but also to the principal cities upon the sea-board, and those cities will in return transport the products of their commer-

cial enterprises to the interior settlements of this region of Pennsylvania, which will be extended in proportion to the development of its extensive and valuable mineral resources. J. H. L.

Hunt's Merch. Mag., Sept., 1848.

Copper Sheathing.

A correspondent of the Mining Journal states, as the consequence of his experience, that, in the treatment of the sulphurets of copper, there should be one calcining, one roasting, one smelting, and one refining—four operations in all; and that care be taken that no iron tools be used, except the ladles for the refining process. The carbonates of copper require only two operations—smelting and refining; but if copper pyrites be mixed with the carbonate, it will require three operations instead of two. By attention to these operations all foreign matter will be disengaged. The production of good malleable and pure copper, depends on the refiner; the copper is brittle before, and should be stirred with a wooden rod. It requires considerable care to keep the metal to a proper heat until the moulding is finished, to give it due ductility, and make it suitable for the demands of commerce. In general, most operators go too far in the refinery, which renders the metal fibrous, and the result is serious lamination on one side of the sheet. If the copper ore is properly treated in the above operations, this metal is decidedly the best for ships' bottoms. The per centage of copper is also much increased by careful treatment, and the scoria comes out cleaner. Civ. Eng. & Arch. Journ., Aug , 1848.

Artificial Colors in Agate.

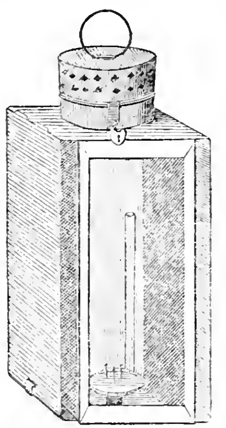
The change of color produced artificially in the agates, by the workers in them at Oberstein, an art learned from the Italians, and to which Mr. Hamilton calls attention in his communication, stating his belief, (referring also to the labors of M. Noeggerath,) that not a few of the onyxes which have come down from ancient times were thus treated, is of much interest mineralogically, since it shows the very different porosity of different layers in the agates, the least porous bands not being necessarily the nearest to the centre, but dispersed irregularly through the mass. To this porosity Mr. Hamilton calls attention, citing the researches of M. Noeggerath, who states, that in some layers the minute hollows can be seen by means of a magnifying glass; that, while some are round, others are long, and that they sometimes run into one another. These hollows, Mr. Hamilton considers, may form interstices between the radiating crystals. By immersion for some time in honey and water or olive oil, so that the pores of the agate become more or less filled with a substance to be carbonized, a subsequent soaking of the stone in sulphuric acid produces a difference in the agate according to the porosity of the layers, the most porous becoming black, while the least porous remain white or uncolored.—By immersion in a solution of sulphate of iron, and a subsequent

heating of the agate, a carnelian red is in like manner obtained for the most porous layers, the iron being converted into a peroxide, while the least porous layers continue unchanged in color. It would be out of place further to dwell upon the infiltration of mineral matter in solution into the isolated cavities of rocks. The mode in which the various minerals occur is highly interesting, as also their connexion with the matter filling veins and fissures in adjoining parts of the same or adjacent rocks, as, for example, the filling of the fissures in the red conglomerate, by the same kind of siliceous matter which entered into the cavities of the igneous rocks of Idal, the layers having, in both cases, adjusted themselves to the surfaces on which they were accumulated.—*Sir Henry T. De la Beche's Address, delivered at the Anniversary Meeting of the Geol. Soc. of Lond., Feb.* 1848.

Edin. New Phil. Journ., No. 89.

Safety Mining Lanthorn.

Mr. Crane, of Birmingham, has forwarded to the Mining Journal the following description of a mining lanthorn that he has invented. The annexed drawing is a representation of the safety lanthorn:—It



is adapted to burn composition candles that require no snuffing. The same principles can, however, be applied to oil lamps, if any party prefer oil to candles. The front is made of strong glass; the back of polished tin—the two sides of wire gauze, soldered to the framing, having 900 apertures in a square inch of surface. It will do coarser: but the size stated is safest. Over the wire gauze sides are fixed covers of tin, hinged to the top of the lanthorn, which entirely cover the sides, and are kept fast by a small hasp at the bottom. The lower edge of each tin coverside is bent inwards to rest against the framing—so that the tin plate may be kept at a distance of $\frac{1}{4}$ inch from the wire gauze. Sufficient space is thus provided to allow of the passage of air for the supply of the light. These tin coversides are useful to protect the wire gauze from injury and dirt, as well as to stop any current or "blower" of gas from blowing out the light. No direct current of wind can have any effect upon the light, because there is no admission into the lanthorn but obliquely at each corner. The candle is held between four short wires, soldered in the dish of a movable socket, which fits into a socket soldered to the bottom; this candle socket is useful for retaining any waste fat that may run down; it can be lifted out by the wire handle, and cleaned, when necessary. The inside of the lanthorn is thus kept quite clean. The candle is put in through the neck on the top of the lanthorn, upon which a hinged lid fits down tightly.—The lid is pierced with two rows of holes, through which the heated air and smoke escape; and to the top is fixed a large ring, by which the lanthorn is carried and hung up. This ring is kept cool by a sim-

ple, but effective contrivance. A piece of tin, bent into the form of an inverted cone, is soldered inside the lid, which causes the hot ascending air to flow towards the sides, where it immediately escapes through the openings. To prevent any inflammable gas entering through the lid, a circular disk of wire gauze is soldered inside the rim of the lid—so that no gas can enter but through the wire gauze; this wire gauze will never become red-hot, so that no explosion can possibly occur. The size of lanthorns made is about 5 inches square, and 12 inches high; other parts in proportion. The inside of the tin coversides, and the outside of the lanthorn, are japanned of any dark color.

Civ. Eng. & Arch. Journ., Aug., 1848.

Description of Two Recent Inventions of Artificial Stone, with Remarks by Mr. Faraday.

Mr. Faraday said that, in undertaking at a short notice to describe the principles on which those artificial stones were constructed, he refrained from expressing an opinion as to their probable commercial success. He explained the process adopted and the object aimed at, first in Mr. Ransome's, and afterwards in Mr. Buckwell's invention. Broken flints are dissolved in a solution of caustic alkali at a temperature of 300° Fahr. When this solution is sufficiently evaporated, siliceous sand, or the flint grit of roads, and a little clay are worked with it, till the whole is of the consistence of putty. It is finally pressed in moulds, dried, fired for 48 hours, and then slowly cooled. The impression produced is very sharp; the stone resembles white sandstone, and is said to resist all atmospheric changes, and even acids. Philosophically considered, this artificial stone is a mass of sand cemented together by glass. The glass, at first containing excess of alkali, is diffused in a fluid state throughout the particles of flint and alumina. These particles absorb the superabundant alkali when the stone is fired, and the resulting vitreous cement resembles, in hardness and resisting power, the portion of glass which, in the common manufacture of the hardest kinds of that substance, is found in immediate contact with the sides of the pots. To show the unstable nature of ordinary glass, Mr. Faraday exhibited green bottles in which diluted sulphuric acid had been kept. In the glass of these bottles the lime had been separated from the silica by the sulphuric acid, and the insides were in consequence studded with multitudes of regularly-formed cones of sulphate of lime. Mr. Faraday then entered on Mr. Buckwell's manufacture. As the artificial stone invented by Mr. Ransome is chiefly applicable for ornamental purposes, so Mr. Buckwell's invention, termed by him *artificial granite,* appears exclusively designed to supply the place of blocks brought from the quarry for large works, whether walls of houses or of aqueducts, sewers, &c. Mr. Buckwell uses the following simple process:—Fragments of a suitable stone (Portland stone, for example) are gauged and sorted into sizes. These are cleaned and carefully mixed on a board with cement in the proportion of 5 parts of large fragments, 2 of smaller ones, 1 of cement, and a portion of water,—but the water is in *no*

greater quantity than will bring it to the dampness of fresh deal saw-dust. This being done, the materials are put into a strong mould to the depth of 1½ inch at a time; they are then *driven together by percussion*, more materials are now put in, these in turn hammered together till the water has escaped by holes pierced for that purpose in the moulds,—and this process is continued till the block or pipe has attained the required magnitude. It is then taken out of the mould, and now found to be so hard as to ring when struck, and in ten days is fit for service. It is affirmed to harden under the influence of moisture, to bear, when moulded in the form of girders, a greater transverse pressure than any rock except slate, and to be only one-sixth of the cost of brick-work. It will be noticed that this process is characterized by the use of fragments, by the small quantity of cement employed, (not one-fourth of the proportion used in common *grouting*,) and by water, instead of fire, being made the means of bringing the fragments into close union. Mr. Faraday then noticed two scientific principles on which the success of Mr. Buckwell's process greatly depends:—

1. *The use of water in effecting the approximation of the particles and the exclusion of air.*—It had been ascertained by Dr. Wollaston (Bakerian Lecture, 1828) that in order to bring the particles of platina into close contact, it was best to bring them together in water. When a freshly made road is watered to make the materials bind together, the same principle assists in the result. Having filled a measured glass with sand, Mr. Faraday showed that when the glass was first filled with water and then the sand added with agitation, it occupied less space than it did when dry.

2. *The effect of percussion in bringing particles together.* Mr. Faraday noticed, that simple pressure will not displace intersticial air or water, but that a blow will. Water contained in a small cylinder of wire-gauze was shown remaining in the open net-work when subjected to the pressure of a column of the same fluid, though it freely ran through the meshes when the cylinder was gently struck. On the same principle the moistened sand on the sea shore gives way, and leaves a footmark under the impact of the limb which strikes it. In conclusion, Mr. Faraday noticed the remarkable fact that the sedimentary matter in sewers, &c., does not accumulate on Mr. Buckwell's artificial granite as it does in glazed pipes.—*Proc. Roy. Inst.*

London Athenæum, June, 1848.

Russian Monolith.

The Journal of the Polytechnic Society for October, 1847, notices a stone quarried in Russia, under the direction of M. Monferrard, a French Architect, for the purpose of erecting a statue of the Emperor Alexander. The block is 30 metres (98·45ft.) in length, by 7 metres (22·97 feet) square, and the weight is estimated at 4,700,000 kilogrammes (4626 tons). It required the labor of 600 workmen for two years to prepare it, and 80 iron capstans and 2000 men were employed in its erection.

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CIVIL ENGINEERING.

On the Steam Power of the Locomotive Engine.

Extract from the Report of the Railway Commissioners, on the Broad and Narrow Gauges, to the House of Lords.

The steam power of the locomotive engine may evidently be increased, as an increase of gauge permits the size of the engine to be increased; but the power can only be applied to the load through the friction between the driving wheels and the rail, or, as it is technically termed, through the adhesion. The steam machinery is employed to turn the wheels of the engine, and those wheels will revolve without progressing, if the resistance to the forward motion of the engine and train be greater than the friction between the wheels and the rails.—Whatever the steam power of the engine may be, its useful effect is limited by the adhesion. The adhesion is limited by the weight which can be given to an engine, and the proportion of that weight which can with safety be thrown upon a pair of wheels, or by the action to which the rails can be exposed; and although the rails might be made of such strength, and be so secured and laid on such a foundation as to be able to bear the rapid movement of almost any weight, still the expenses of construction and maintenance impose a practical limit; and the replies of the eminent engineers of the Great Western and London and North Western Railway Companies, to the inquiries relating to these subjects, which will be found in the sixty-ninth and following pages of the Appendix, have an important bearing on the question.

After carefully considering those replies, the Commissioners are in-

clined to believe that, when the highest rates of speed are to be used, the adhesion of one pair of driving wheels ought not, at the present time, to be estimated to exceed between 3500 and 4000 lbs.; and it appears to be fully admitted, that, when such speeds are required, the adhesion of only one pair of wheels can be employed.

If, at the required speed, the tractive power afforded by the steam machinery of a well-proportioned engine, adapted to a particular gauge, be less than this, a better engine for such speed would be obtained by increasing the gauge; but any increase of the gauge beyond the width necessary to obtain the additional steam power required, would, so far as the power of the engine is concerned, be unnecessary.

It is useless to consider to what gauge this particular view of the subject might assign a preference. It only appears necessary to inquire, whether the steam machinery of well-proportioned engines adapted to the narrow gauge can afford, at the high speeds maintained upon the broad gauge, a tractive power equivalent to the adhesion of their driving wheels; and if not, what advantage over such engines, with respect to load, an engine must possess, which can employ its full power of adhesion, at the speed assumed as the maximum upon a level line, and to what extent that advantage would be affected by different gradients.

To enable the Commissioners to arrive at some conclusion on this subject, the queries which will be found at page 43 of the Appendix, were sent to the Great Western, and the London and North Western Railway Companies, to obtain the facts which are necessary to be known, before a perfect conclusion on the above inquiry can be arrived at, and which it was hoped the experience of the engineers of those Companies would enable them to supply. A reference to the answers returned to those queries, which will be found at the 48th and following pages of the Appendix, will show the very great uncertainty which still exists on many of the points embraced in them.

Experiments similar to those which have been made by Mr. Gooch, and given with his replies, would probably, if made by different parties on different lines, afford correct data for this investigation; but it is necessary now to endeavor to form the best judgment which the present state of information will permit.

The tractive power afforded by the steam machinery of a locomotive engine, at high velocities, principally depends upon its power of evaporation, or the quantity of water it can convert into steam within a given interval; and an assumption may be made on this point with tolerable confidence; but of the deductions to be made from the whole amount of steam power created for various resistances in the machine itself, and of the resistance of trains at different velocities, it is not possible, from the replies given, to form satisfactory estimates.

From the evidence given before the Gauge Commissioners, and the experiments detailed in the Appendix to their Report, it might be supposed that about 180 cubic feet per hour is a fair estimate of the evaporative power of narrow gauge engines; but, from the replies given to the above-mentioned questions, the Commissioners believe they are justified in assuming that there are well proportioned narrow gauge engines, having an evaporating power of 200 cubic feet per hour.

An engine with this evaporative power, and having 16-inch cylinders, a stroke of 21 inches, and $6\frac{1}{2}$ feet driving wheels, when cutting off the steam at $\frac{5}{8}$ths of the stroke, may, it appears to the Commissioners, be fairly considered to have its power limited by its adhesion for all speeds under forty miles per hour. At that speed, the Commissioners believe the tractive power afforded by the steam machinery is nearly equal to the adhesion assumed at 3700 lbs., that it rapidly diminishes as the speed increases, and that the power of the engine may be thus stated at the under-mentioned velocities on a level:—

Miles per hour.	Load exclusive of engine and tender.
40	140 tons.
50	60 "
60	22 "

If the tractive power afforded by the steam machinery at sixty miles per hour, were equal to the adhesion, a load (including the weight of the engine and tender) of from 100 to 120 tons might be conveyed. The largest engines now in use on the broad gauge lines, have an evaporative power sufficient to accomplish this; and, allowing for their greater weight, it may be considered that they can draw an ordinary passenger train of sixty tons weight with as much facility, on a level, at sixty miles per hour, as the narrow gauge engines can at fifty. On moderately descending gradients, the larger engine would possess a similar degree of advantage; but in proportion as the inclinations increased, and considerations of safety imposed a limit to the speed, the advantage would diminish and disappear.

On ascending gradients, the difference between the power of the narrow and broad gauge engines varies. As the ascent increases in steepness the difference diminishes; but the inclination on which it may be considered that the two engines would have equal power, over a train of sixty tons, is dependent on the resistance of such a train at different rates of speed, respecting which a correct opinion cannot at present be formed. Adopting, however, for such resistance, a mean between the results obtained by Mr. Gooch, and those approved by Mr. Harding, in the communication made by him to the Institution of Civil Engineers, and referred to by Mr. Locke, and by Messrs. Stephenson, M'Connell, and Trevithick, in their replies, given at page 72 of the Appendix, it appears to the Commissioners that, on an ascent of 1 in 170, the two engines would have nearly the same power over a train of sixty tons, and that, on steeper gradients, the greater weight of the larger engine would cause the difference to be in favor of the smaller engine. If, however, the greater steadiness of the larger engine will allow a greater weight to be thrown, with safety, upon the driving wheels, when high speeds are to be used, than has been assumed, the difference in favor of the larger engine would diminish more slowly, and it would maintain an advantage on a gradient steeper than 1 in 170, depending on the amount of additional weight; and if the resistance of the trains on the broad gauge be less than on the narrow, as might be inferred from a comparison of the experiments above mentioned, if correct, the result would be yet more favorable to the former. **Lond. Rail. Journ., No. 475.**

The Ordnance Survey of the Metropolis.

The area intended to be comprised in the metropolitan survey is something above 200 square miles,—or nearly 130,000 acres; and the map is to be constructed on the very large scale (for a district of such an extent) of 60 inches to a mile, or one inch to 88 feet,—which, when completed, will occupy about 900 sheets, three feet by two feet, or about 5400 square feet of paper or copper. The London survey will be connected, by its triangulation, with the general survey of the country, and, in its levelling, with the one uniform datum plane to which the altitudes of the Ordnance six-inch map are referred. By this means, when the map is complete, the relative levels of any two points within the eight mile radius of the metropolitan survey, or of any part of London, and any part of the north of England, may be seen at a glance by those who require, and know how to look for, the information.—*Builder.* Lond. Athen., July, 1848.

Railway Commissioners' Report on Railways.

This Report, issued on Tuesday, contains in 223 pages, articles on accidents; opening of railways; cheap trains; by-laws; exercise of powers under general Acts, and under special Acts; references under Standing Orders; Reports on Colonial Railways; statistics, returns, &c. The Appendix contains the several Reports made by the Inspectors of Railways, relating to openings, accidents, &c.

On the opening of Railways it states, that during the last two years, a very large addition has been made to the extent of railway open for traffic: at the end of 1845, it appeared that 2441 miles were available to the public; 595 miles were opened in 1846, and 780 miles in 1847, making the whole extent of railway completed at the end of 1847, 3816 miles: of which 3157 are in England; 440 in Scotland; and 219 miles in Ireland.

Between November, 1846, when the Commissioners entered upon their duties, and the end of 1847, they were called upon to direct preliminary inspections previous to openings, in 100 instances, of which 94 occurred in 1847. It 21 cases it was considered necessary by the Board to postpone the opening, either of the whole, or of a part of the railway inspected; and in 40 cases, when authorizing the opening, the Commissioners thought it necessary, for the public safety, to make suggestions respecting a temporary or permanent restriction of the speed on certain parts of the line, the arrangement of signals, points, &c. Besides the important object of providing for the public safety, the inspection required, previously to the opening of the railway, may be of public utility, by affording the means of ascertaining whether the line and works have actually been constructed in due conformity with the provisions of the Act by which they were authorized, and in several instances unauthorized deviations have thus been reported to the Commissioners. In one instance Captain Simmons, in the report of his inspection of a part of the Waterford and Kilkenny Railway, stated,

that the gradients do not accord with the Parliamentary Section, the surface of the ground, as it exists, being entirely of a different form from that delineated on the Parliamentary section.

On inquiry, it appeared that the errors in the section submitted to Parliament, on which the Company obtained their Act, are so very great, that the objects of the Legislature in calling for detailed sections, have been entirely frustrated, and no person whose property was likely to be affected by the line, could form any judgment of the manner in which his property would be interfered with. They have been informed, that no complaints have been made by landowners or others, with respect to that portion of the line which has been already executed.

Under the head of statistics, a table is given, showing the results of returns presented to Parliament, for the several annual periods for which they have been made up since 1843, showing the rapid rate at which the amount of railway transport is increasing, from which we extract the following:—

Summary of Traffic Returns on Railways in the United Kingdom.

Traffic for year end'g June 30.	Miles opened at middle of each period.	Total Number of Passengers.	Receipts for Passengers.	Receipts for Goods.	Total Receipts.	Traffic per mile per annum.
1843	1,857	23,466,896	£3,110,257	£1,424,932	£4,555,189	£2,442
1844	1,952	27,763,602	3,439,294	1,635,380	5,047,674	2,599
1845	2,148	33,791,253	3,976,341	2,233,373	6,209,714	2,891
1846	2,441	43,790,983	4,725,215	2,840,353	7,565,569	3,099
1847	3,036	51,352,163	5,148,002	3,362,884	8,510,886	2,803

The following table has been compiled from returns relating to the financial transactions of Railway Companies:—

	Length of Railway authorised to be made.	Capital authorised to be raised by Shares and Loans.	Nominal Value of Stock on Shares.	Amount actually raised.			Length opened for Traffic.
				On Shares.	By Loans.	Total.	
	£	£	£	£	£	£	
Prior to 31st Dec. 1843	2,276	82,840,082		43,468,641	22,062,151	65,530,792	1,952
During 1844	805	20,454,698		4,341,519	2,479,256	6,820,775	196
1845	2,700	59,479,485		15,622,831	506,978	16,129,809	293
1846	4,538	128,918,207		30,856,627	6,958,366	37,814,993	595
1847	1,354	44,879,739		32,173,973	8,851,514	41,025,487	780
	11.673	336.580.210	222,635.668	126,463,591	40.858,265	167,321,856	3,816

In the foregoing table, the several sums are principally derived from the returns made by the Railway Companies. It states that it may be assumed that, at the end of 1847, all the lines authorized previously to 1844 were completed; of 805 miles sanctioned in 1844, there had been 665 miles opened for public traffic, and the remainder were in progress; of 2700 miles authorized in 1845, there had been 786 com-

pleted; and of 4538 miles authorized in 1846, there had been 84 completed. From this it appeared, that, under ordinary circumstances, the railways sanctioned in one session of Parliament, are completed within 4½ years from the end of that session; that less than one-fifth of the whole require more than 3½ years for their completion; about one-half requiring between 2½ and 3½ years; and the remainder less than 2½ years. That if Railway Companies had experienced no extraordinary difficulty in raising capital during 1847, it may be estimated that their expenditure in that year, under the Acts of 1844-5-6-7, would have been £64,000,000; but that little more than £41,000,000 were raised for railway purposes in that year. And if that be assumed as the limit which their expenditure will be able to attain, it will require four years for them to obtain the capital now authorized, but not yet raised by them. And if this expenditure be maintained, and the capital authorized be sufficient for the completion of the several lines, it may be expected that about 2000 miles will be completed annually during the next four years.

We do not think it likely that this supposition will be realized, or even a moiety thereof. **Lond. Rail. Journ., No. 475.**

Waterloo Extension of the London and South-Western Railway.

The extension of the London and South-Western Railway from Nine Elms to Waterloo Bridge road, was opened on the 11th ultimo. It appears to us that it would have been far better if the Waterloo Station had been made on the vacant ground adjoining, north of the present Waterloo terminus, and the principal entrance in York road. The entrance to the railway would then have been as near to Westminster and Hungerford bridges as it is now to Waterloo bridge, without increasing the distance to the latter place, or the length of the railway. This alteration might now be easily made; it would save nearly half a mile, and eight minutes' walk, to foot passengers from Westminster and Charing Cross; the present approaches might be retained for a goods depôt—and if a steamboat pier were made adjoining to the Surrey approach of Hungerford bridge, and arrangements made with the steamboats to come direct from London bridge to the pier, the extension of the railway to London bridge might be abandoned, and thereby nearly a million sterling saved. This would, we are sure, enhance the value of the shares, and give confidence to those capitalists in the city who are now alarmed at the apparent reckless manner in which funds are being expended by railways on branches and extensions.

The works of this undertaking were commenced in July, 1846, by Messrs. Lee, the contractors, who engaged to complete the works by the 1st of July, 1848. Mr. Thompson acted as the superintendent to the contractors, and Mr. Curlieu on behalf of Mr. Locke, the engineer. The length of the new line is nearly 2¼ miles. The first quarter of a mile is carried over an embankment; then succeeds a viaduct, consisting of six massive iron girder bridges, and 300 arches, (exclusive of those forming the present station in the Waterloo road.) These arches,

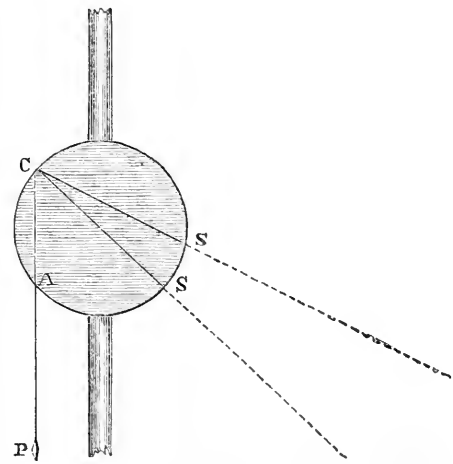
which are expected to form a very considerable item in the receipts of the company, have been so carefully constructed, as to be easily applicable to various purposes, and their perpetual dryness has been insured by the application of the Seyssel asphalte, which has rendered them impervious to wet. There are four distinct lines of rail, and the quantity of iron alone consumed in laying down what is technically called the 'metals,' is at least 1200 tons, independently of about 800 tons weight consumed in the erection of the bridges. In the construction of the viaduct and station of the Waterloo road, upwards of 80,000,000 of bricks have been consumed; and the present terminus, which is all on arches, covers a space of three-quarters of an acre of ground, its width being 260 feet. The major part of the present terminus has been coated with Claridge's asphalte, so that the arches on which it rests may with safety be made use of as storehouses, &c. To the present terminus in the Waterloo road there are no less than four approaches for carriages and foot passengers, the pedestrians having, in each approach, footpaths eight feet in width. The stations at both Waterloo road and Vauxhall are only temporary. The fares on the main line are increased as follows:—First class, 6d.; second class, 4d.; third class, 2d. The Nine Elms station is now closed entirely to passenger traffic. Civ. Eng. & Arch. Journ., Aug., 1848.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Methods for Ascertaining the Side Slopes on Railroad Embankments and Cuttings.

I have seen described, within two or three years, several methods for ascertaining the side slopes of railroad embankments and cuttings, most of them, however, present objections, from which I think the following free. The method most followed in the United States, that of approximation, is tedious, particularly where the ground is rough or very undulating.

Fig. 1.

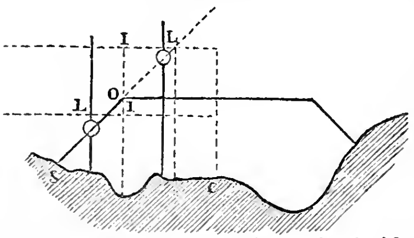


For accurate work, the disk of the level target should be from 9 to 12 inches in diameter. At one corner, if square, or at C, if round, fix into the target a fine pin, with a button on the outer end, so as to prevent from slipping off, the loop of a fine silk thread, CP or CS. With a fine edged tool, draw a straight line, CA, by which, with the plumb line, CP, the rod and target will be kept in proper position in operations. From C to S draw the line CS, which should make, with the line CA, the angles made by the slopes of the

work with a vertical line. A fine silk thread, of some thirty feet in length, should also be provided, to loop over the button at C.

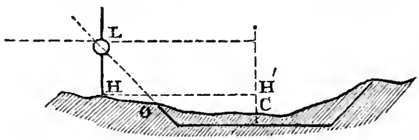
It will now be evident that, if the rod be set plumb, so that the point C shall be placed in the plane of a slope, that by extending the silk thread over the line CS, the intersection of that line with the natural surface will be a point for a slope stake.

Fig. 2.



To find the slope stake at S, having on the ground the centre stake, and the fill, set the level, and, by placing the rod on the centre C, ascertain how much the level is above or below the top of the embankment contemplated; then, if the slope is 1 to 1, and the level strikes above the embankment, a distance OI, subtract that distance from the half width of the embankment, and measure off from C the remainder, and at the point where that distance falls, set up the rod, and raise the target till the button with loop strikes the line of sight. Then extending the silk thread to the ground, along the line CS, (fig. 1,) the point is fixed. If the line of level strikes below the top of the embankment, then the line LI, added to the half width, will be the distance from the centre stake at which the rod is to be set up, and proceed, as before, to raise the target, till the button strikes the sight from the instrument. It will be evident that if the slope of the embankment runs with a different angle, say, as $1\frac{1}{2}$ to 1, then the line IL must bear the same proportion to IO.

Fig. 3. *To Find the Slope Stakes of a Cut.*



Here it is evident that the instrument must be set above the surface, or that there is but one solution. The instrument being set at A, and the rod on C, the centre pin, the height of the instrument above the bottom of the cut is ascertained; then, if the slope is 1 to 1, the distance HH', equal to the half width at the bottom, added to the height of the instrument above the bottom, is measured off to H from the centre pin, and the rod set up there, the target raised as before, and the point O found.

With this method, both slope stakes may frequently be ascertained, for several stations, without moving the instrument. B.

On the Velocentimeter, with its Applications.

Read before the British Association for the Advancement of Science.
By Mr. Whishaw.

He stated that, in the year 1837, he was engaged in working the general survey of the railways in Great Britain and Ireland; and that

he invented the first velocentimeter, for the purpose of testing more readily than by the ordinary watch, furnished with a second hand, the time occupied in passing over measured distances, which were usually marked by posts or standards. He now exhibited an improved instrument, which resembled a handsome chronometer—and observed that it had tabulated thousands of miles, without being out the hundredth part of a minute. He stated that by it, with the assistance of the electric telegraph, the time of the United Kingdom could be made uniform to half a second. Lond. Athenæum, Aug. 1848.

Notice of the Death of George Stephenson, Esq., *Civil Engineer.*

On the 12th instant, died Mr. George Stephenson, the author of the railway system, the first great practical improver of the locomotive steam engine, the inventor (cotemporaneously with Davy) of the safety-lamp, and a man who displayed a vigorous and original genius in everything which he undertook. He was born on the 9th of June, 1781, (was consequently, at the time of his death, in his 60th year,) at a little village near Newcastle-on-Tyne, of parents in the humblest rank of life. His first occupation as a boy, was attending to the steam engines used at the mouth of coal pits. Eventually he became a coal viewer, or surveyor and overseer; and distinguished himself in the coal district by an improved mode of carrying on some great works at Darlington. In 1812, a committee which had investigated the priority of the claims of the discoverers of the safety-lamp, gave him a public dinner at Newcastle, at which he was presented with a silver tankard, and a purse of a thousand guineas. In returning thanks, he announced his intention of devoting that sum to the education of his only son, Robert, at the University of Edinburgh. The history of his employment to construct the Stockton and Darlington, the first public railroad, and the Liverpool and Manchester, the first on which locomotive engines were introduced for the conveyance of passengers,—is well known. From the first journey of the locomotive built by the Stephensons over the railroad constructed by them, dates the actual commencement of the greatest mechanical revolution effected since the invention of the steam engine by Watt. Though self-educated,—scarcely educated at all beyond reading and writing until he had attained manhood,—Mr. Stephenson took every opportunity of impressing upon the young the advantages of science and literature. He related at a public dinner, at the opening of the Birkenhead Docks, how, in his early career, after the labors of the day, he used to work in the evening at mending watches and clocks, in order to earn enough to send his child to school. He was the founder and first president of the Society of Mechanical Engineers, and was never better pleased than when assisting by his advice and encouragement, the ideas of ingenious artizans. In agriculture and horticulture he made many curious and successful experiments,—and the study of geology was a passion with him. It is feared that the intermittent fever, of which he died, was occasioned by the damp miasma arising from the fertilizers, which he employed with

great success in his hot-houses. In a brief and hurried notice, it is impossible to do justice to so remarkable a man. In the words of a cotemporary writer: "His mechanical genius was of that order that it may, without exaggeration, be asserted that if Watt had not previously invented the steam engine, he was capable of achieving it. Others before him had prepared the way; others since have contributed valuable improvements in detail; but to George Stephenson unquestionably belongs the proud title of the Author of the Railway System. He gathered the many threads of ingenuity and enterprise, and weaved them into the wide-spreading net-work which promises, in its manifold extension, to envelope the whole world in bonds of commerce, civilization, and peace." Ibid.

On the Improvements which have been made in Steam Navigation.

Read before the British Association for the Advancement of Science.

By Mr. Scott Russell.

The first great improvement that had been made was in the boilers. Formerly, the boiler flues were constructed of great length, so that the smoke was kept winding round and round in the flues, and at last was allowed to escape with difficulty. Now, however, they had adopted the plan of getting as much fire as possible, in the shortest space of time,—and this had been accomplished by imitating, as nearly as they could, the locomotive engine boiler, by having tubes of thin metal, which would evaporate a much greater quantity of water in the same time as flues of the usual thickness; now, also, instead of taking the smoke a long dance, as in the old fashion, they used short flues of four to six feet in length, and by having a great many of as thin metal as possible, they heated the greatest quantity of water, and had the additional advantage of keeping the metal cool,—in consequence of which a boiler of smaller extent and surface was of much greater efficiency, with less weight of metal. The next point of improvement was in the engine, in the construction of which, however, there had been less change than in other matters. The former beam engine had been changed for the direct action engine, which was of various kinds; but the greatest change which had been made within the last ten years, consisted in the employment of greater quantities of wrought iron in the construction of the engines, instead of the mass of cast iron formerly used. This was the only great change,—for the newest Halifax steamers were still fitted up with the old-fashioned or lever engines. The next improvement consisted in working steam expansively to a much greater extent than heretofore. It was only within the last ten years that they had adopted this principle: the effect of which was, that, instead of completely filling the cylinder with steam, they filled only to the extent of one-fourth—a volume of steam not of course of equal density, but by which they got two-thirds of the work done, and at one fourth of the cost. The next improvement had been made in the paddle; not so much, perhaps, in the wheel itself—for he was still inclined in favor of the old paddle-wheel, although, for short voyages,

he admitted the advantage of the feathering paddle-wheel, which had been advocated by Mr. Price at their meeting some years ago, and he had then opposed him—but of this by-and-bye. Another great improvement which had been made, was the driving the paddle-wheels faster. They had an old maxim, which was, whereas a good old horse, going $2\frac{1}{2}$ miles an hour, could not draw advantageously at more than 220 feet per minute, and that, as the steam engine was only a substitute for horses, and reckoned as so much horse power, it ought not to go faster than $2\frac{1}{2}$ miles per hour—and this one thing had kept them back for half a century. He did not mean that the result should be faster than $2\frac{1}{2}$ miles per hour, but that the piston should not rise up and down in the cylinder faster than $2\frac{1}{2}$ miles an hour, which was only 4 feet in a second, while the motion of steam of 15 lbs. was 1100 feet in a second. Fortunately, however, this old maxim had been abandoned, and the piston now moved from 250, 270, to 300 feet in a minute. For this improvement they were indebted to no new principle, but to the application of mathematical principles of science. He now came to another great improvement, which was the change in the formation of steamboats, which had been radical—he meant the entire alteration in the form of the ships. A few years ago, steam vessels which would go ten or twelve miles an hour were deemed fast ships; now, however, we had attained a much higher rate of speed. Vessels were then built on the old-fashioned principle that the water-line should be nearly straight, and that the run of the vessel should be a fine line, and that there should never be a hollow line, except a little in the run of the ship, but that there most certainly should not be any hollow line in the bow, for there the water-lines should be straight or a little convex. Researches and inquiries were, however, made by a Committee of the British Association, as to the form which would enable the vessel to go fastest through the water. These inquiries lasted for years, and they established, by a series of experiments, a set of very curious facts. Formerly, every builder of ships had his notion of proportion; some that the length should be four times the breadth,—others that it should be $4\frac{1}{2}$ or 5,—and some went as far as to say that the length should be six times the breadth, but these were deemed innovations: so that, although the proportions of width, as compared with breadth, were said to be fixed ones, yet strangely enough, every one differed as to those proportions. Another question was, what part of the vessel should have the greatest width, and it was generally thought that the greatest width should be nearest the bow. Some daring persons had, however, put it back as far as the centre of the ship. This was, however, the exception, and not the rule. Then there was another great principle, which was, that the bow and the stern should exactly balance each other,—that is, that the vessel should be equally balanced; but the new rules which the British Association had established were as follows:—They began by upsetting the old rule with respect to the proportions which the length should bear to the breadth, finding that the greater the speed required, the greater should be the length, and that the vessel should be built merely of the breadth necessary to enable the engines to be put in, and to stow the

requisite cargo. Then the second great improvement made by them was, that the greatest width of water-line, instead of being before the middle, should be abaft the middle of the vessel, and, in fact, two-fifths from the stern, and three-fifths from the bow. The next great improvement was that, instead of having the bow broad and bluff, or a cod's head bow, for the purpose of rising over the wave, you might have hollow water-lines, or what were called wave lines, from their particular form, and with that form the vessel would be propelled with less power and greater velocity,—and also, that instead of keeping to the old fine run abaft, and cutting it away, you might, with great advantage, have a fuller line abaft, provided it was fine under the water. Thus, by these improvements, the form of the old vessel was pretty nearly reversed, to the great annoyance of the old school, and the steamers were given large and commodious cabins and after holds, instead of having cabins so pinched in that you could hardly stand in them. Another heresy, introduced by the British Association, was that of the principle as to the balance of the stern and the bow upon which they now rested; but which was founded in a most singular error, for they left out something which was very material. They concluded that the wave acted equally on both ends of the vessel in striking it; but they did not take into consideration the impossibility of this when a vessel was moving, not having taken into calculation the velocity of the wave, or of the vessel, and that from this circumstance, the concussion from a wave striking the bow would be a most powerful one, while it could not be so with regard to the stern, because if the velocity of the wave meeting it was fifteen miles, the shock would be as of thirty miles; and, therefore, it became most plain that the bow would give the greatest resistance to the wave. He had examined all the fastest steamers which had accomplished fifteen to seventeen miles an hour—and in smooth water eighteen miles an hour; and he would venture to state that there was not one of them, which accomplished from fifteen to seventeen miles an hour, which had not all these alterations in every particular, and that the wave form and wave principle were now adopted by all the great steamship builders, and that all the fast steamboats had what was called the wave bow. Now, of the eight boats on the Holyhead and Dublin stations, if examined, it would be found that all of them were built on these principles, although in some of them there was still left a little of the old principle, some of the boats being made a little fuller and more straight; and if any one would look at one of these boats, it would be perceived that the moment they moved, the very wave itself rebelled against them, and broke against their bows,—and that consequently these were slower than any of the others. All of them, however, were vessels of the first class; and he gave the details of their construction,—for which we have not space. All of them were examples of the value of the form, and the principles which the British Association had advocated and introduced at a very early period in its history.

Mr. J. Taylor stated that as Treasurer of the Association, he could bear witness to the value of the efforts of the Association in this direction; and he felt bound in justice to state, that the credit Mr. Russell

had given to the Association, was chiefly due to himself, as the individual who, with the late Sir J. Robinson, had conducted the investigations on this subject.

Mr. J. Price rose to say that he agreed with Mr. Russell in all that he had adduced. There was, however, one mode of steam navigation —one mode of propulsion to which he had not alluded, he meant the mode of propulsion by the screw propeller. He would, therefore, mention that they had built a little vessel, called the Neath Abbey, which plied from Neath to Bristol, a distance of upwards of sixty miles, and which had only two 12-inch cylinders, in fact a mere toy— of course using high steam. Now, she could walk round the Beresford, which had two 40 horse power engines:—the working her upon the high pressure steam principle necessarily increased the speed of the piston. With these engines they had stepped out of the old track. They had not adopted the American plan of a high pressure engine, and puffing off the steam, but of a high pressure engine without puffing off the steam, and without using a jet of cold water. He confessed that, when this plan was proposed by his younger coadjutors, he, as one of the old-fashioned, hesitated,—but at length he consented. The Neath Abbey had a screw propeller with three blades, which were immersed under the water—her propeller being about 3½ feet in diameter. The vessel is built in the best form, allowing sufficient breadth for her engines. The two 12-inch cylinders are placed diagonally, and slung up by wrought iron beams, and they lay hold of one crank pin, like the hands of two men working at a grindstone; and thus they conducted their engines almost in a snuff-box. They then employed their boiler in the manner described by Mr. Russell. Then they came to the condensation of the steam, which they did not allow to go puffing off, but let it pass back into the boiler, condensed and in a distilled state,—which accounted for their never having any mud or dirt in their boilers. Ibid.

AMERICAN PATENTS.

List of American Patents which issued in the month of August, 1847, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Hydraulic Engines;* James McLaughlin, Philadelphia, Pennsylvania, August 7.

The patentee says,—"My improvement consists in securing to the bottom of the valve a cross-head, having an anti-friction wheel or pulley on each extremity, which run on the under side of the bottom plate of the cylinder, for the purpose of counteracting the upward pressure of the water from the column, against the lower surface of the valve, and holding said valve firmly on its seat during the operation of the engine."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the movable cross head, anti-friction wheels, and bolt, with the valve, traversing with said valve, and holding it firmly in its seat during the operation of the engine, in the manner and for the purpose described."

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2. For an *Improvement in Horse Powers;* David Anthony, Sharon, Schoharie county, New York, August 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I have arranged and combined the interior segment with the driving wheel and traveling pinions, the latter moving round the former, while they turn upon their own axes, and give motion to the wheels which drive the pinion upon the sleeve."

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3. For an *Improvement in Piano Forte Actions;* Timothy Gilbert, Boston, Massachusetts, August 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the spring with the lever and hammer, in such manner as to nearly or entirely remove the weight of them, or either of them, from the key lever, or top of the jack thereof, whereby I am enabled to operate or depress the front end of the key lever, with scarcely any counteracting force, other than what may be sufficient to dampen the string, and, by so doing, make the action both very light to the touch, and powerful in execution.

"I also claim the combination of the lever, with the back catch and key lever, as set forth, for the purpose of enabling the key lever and jack, to be readily removed, independently of the rest of the action. I also claim the combination or arrangement of the spring with the lever, damper lever, and key lever, by which the spring is made to answer the double purpose of causing the return of the key lever and damper, after each blow on the string."

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4. For an *Improvement in Machinery for Twisting Withes;* Jonathan Smith, Frankfort, Waldo county, Maine, August 7.

Claim.—"What I claim as my invention, is the rotating pincer, or twisting shaft, or mandrill, (having pincers, jaws, or other appliances, for holding one end of the pole to be converted into a withe,) in combination with the rotating windlass barrel, for winding up the pole, or straining its fibres in such a manner as to secure the twist put in by the shaft; the whole being constructed and made to operate together, substantially in manner, and for the purpose of making withes, as above specified."

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5. For an *Improvement in the Plough;* George Page, City of Washington, D. C., August 7.

The patentee says,—"The nature of my improvement consists in supplying a revolving concave disk, in place of the ordinary mould-

board, for turning the furrow, and adapting the other parts of the plough thereto."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a concave circular revolving mould-board for a plough, constructed substantially in the manner and for the purpose set forth. I also claim the outer brace and scraper, in combination with the above, for the purposes set forth; and, lastly, I claim the employment of the friction rollers, in combination with the revolving mould-board, substantially as above specified, for adjusting the heel of the mould-board, out or in, to regulate the furrow."

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6. For an *Improvement in Propellers for Vessels;* Horace Everett, Windsor, Windsor county, Vermont, August 7.

The patentee says,—"The nature of my invention consists in providing for the more certain and accurate opening of the paddles, on the forward motion of the wheel; and in securing an efficient action of the paddles on the backward motion of the wheel; and, also, thereby rendering the wheel capable of being used as a vertical wheel; and, as such, of being placed within the body of the vessel; and, when so placed, of being raised, together with the cams, when sails only are used; and of having the paddles protected by side keels; and of being propelled by a crank at each end of the shaft, placed at right angles to each other; and of being more readily repaired at sea."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the outer cam, whereby the perfect opening of the paddles is secured, on the forward motion of the wheel, leaving the paddles free to commence closing on the backward motion of the wheel; and the combination of the modified inner cam, with the roller, whereby a chock between that cam and the paddle rollers, (on the backward motion of the wheel,) is prevented."

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7. For an *Improvement in Cheese Presses;* Chester Stone, Rootstown, Portage county, Ohio, August 7.

The patentee says,—"The nature of my invention consists in connecting together, by means of a single rod, two frames that constitute the levers, the outer ends of which rest and run on the floor; the rod which unites these two frames being made to pass through the ends that work the platen or follower, and the frame of the bed being notched to rest on two rods, one attached to each frame, and at equal distances from the rod that connects the two frames, so that the two rods that support the frame of the bed shall constitute the fulcra of the levers."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is connecting the two lever frames and the platen or follower together, by a central rod, midway between the points of support of the lever frames, when this is combined with the supporting of the bed of the press, on the two fulcrum rods, attached to the lever frames on each side of the central rod, or connexion of the two lever frames and platen, substantially as described; whereby the levers of

the press answer the purpose of legs or supports for the whole press; and by which, also, the whole weight of the frame, and all other parts of the press, act on the lever purchase to give the required purchase."

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8. For an *Improvement in Whiffletrees;* John McLaughlin, Gettysburg, Adams county, Pennsylvania, August 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lever with the spring bolt, for attaching the traces to the singletree, and detaching them therefrom, substantially in the manner and for the purpose set forth."

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9. For an *Improvement in Threshing Machines;* David Anthony, Sharon, Schoharie county, New York, August 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of constructing the beaters upon the main cylinder, and the combination of the latter with the bed cylinders, provided with disks, as described—the whole being constructed and operating substantially as herein set forth."

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10. For an *Improvement in Wool Burring Machines;* William Cundell, Paterson, Passaic county, New Jersey, August 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, making the spaces or slots between the teeth of equal width from the point to the bottom of the teeth, when this is applied to teeth the peripheries of which are concentric; so that when the rings of the teeth are all put together, the outer portion of the space shall be of the same width as the space within, and the surface of each tooth, from point to back, shall be a segment of a cylinder and concentric, substantially as described. And, finally, I claim making shears or guards, for clearing off the impurities, of sheet metal, bent in semi-cylindrical form, and connected together by the edges, and with the included cylinder, by the convex surface, substantially as described."

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11. For an *Improvement in Water Wheels;* Horace Parsons, Houston, Adams county, Illinois, August 7.

The patentee says,—"The nature of my invention consists in making the buckets of the wheel, which extend from the hub to the closed rim, in lines tangential to a circle of less diameter than the hub, and for about one half their depth, parallel, or nearly so, with the axis of the wheel, and the other half extending therefrom, at an obtuse angle, when this is combined with a small shute, for discharging and keeping the water on to several of the buckets at the same time, to act by the percussion and pressure due to the head—the tangential direction of the buckets directing the bulk of the water towards the rim of the wheel, and with a plate on the discharging face of the wheel, which is provided with only one aperture below the axis of the wheel, to

prevent the escape of the water from the buckets, before it shall have exerted its full force on the wheel, and then to exert a force on the oblique position of the buckets, as the pressure in the shute forces the water out of the buckets through this aperture."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making the wheel with buckets formed with about one-half their depth parallel with the axis of the wheel, and tangential to a circle smaller than the hub, or thereabouts, and the other half an angle therewith, when this is combined with a scroll shute on one face, for the admission of the water, and a retaining plate on the other, provided with a hole for the discharge of the water, opposite the end of the scroll, substantially as described."

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12. For an *Improvement in Screw Propellers;* James Montgomery, Memphis, Shelby county, Tennessee, August 7.

The patentee says,—"The nature of my invention consists in constructing a cylinder in the dead wood or other part of the vessel, and in placing within the cylinder so constructed, a second cylinder, containing a screw, the edges of which are firmly secured to this second cylinder, which is thereby made to revolve with the screw. Also in the manner of admitting the water to the screw or propeller, by an opening in the front or outer cylinder."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the propeller in the manner described, namely, an Archimedian screw, or a screw to which an outer rim is attached, to strengthen it, the whole being surrounded by an additional casing, which outer case effectually protects the propeller from injury, and by which a more perfect action is insured."

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13. For an *Improvement in Mortise Latches;* Rhodolphus Kinsley, Springfield, Hampden county, Massachusetts, August 7.

The patentee says,—"The method of making the cases of mortise latches, &c., for which I now claim letters patent, is an improvement on the mode secured to me by letters patent, bearing date the seventh day of March, in the year 1846, and consists in making it in the form of two parallel cylinders, united together by a plane which takes from each cylinder about one-eighth of its circumference, instead of forming it, as under my former patent, by the union of three cylinders, so that a case of about one inch in width can be inserted without mortising, by simply boring two holes, parallel, that run into each other—thus making a latch with a tumbler lever of nearly an inch in length, with a case of only half an inch in the thickness, that can be let into a door, by simply boring instead of mortising, as was the practice prior to the date of my before-recited patent; the bar of the bolt working mainly in one of the cylinders, and the helical spring, which projects the bolt in other cylinders, and the bridle or stirrup of the bolt, on which the lever or tumbler of the spindle works, and which requires considerable thicknesses of metal, also working in the two hollow cylinders, while

the other parts of the bar of the bolt are made thinner, to work in between the two plates, where the two cylinders run into each other."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the case of mortise latches or locks in the form of two cylinders, united and running into each other, the chord where the two cylindrical forms are united being less than their diameter, substantially as described; when this is combined with the bolt, arranged with its greatest width in a plane passing through, or parallel with, the axis of the two cylinders composing the form of the case, in the manner and for the purpose described."

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14. For an *Improvement in Machinery for Making Sheet Lead;* John Robertson, Brooklyn, Kings county, New York, August 7.

The patentee says,—"The nature of my invention consists in forming lead, (or other metal, or compounds of metals having like qualities,) into sheets, by making pressure on a portion of the surface of a mass of metal, in a chamber of the length of the intended width of the sheet or sheets, and thus causing the metal to rise in a thin sheet or sheets, between the surfaces of the chamber containing it, and the die on the face of the ram, by which pressure is made. The ends of the ram or die, thus acting on the surface of the metal to be formed into sheets, being guided at each end in such a manner as to insure parallelism of action, relatively to the face or faces of the chamber containing the lead, or other metal, or compounds thereof."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of making sheets of lead, or other soft metal, or compounds thereof having like or similar qualities, by making pressure on a portion of the surface, and causing it to rise in the form of a sheet or sheets, in a space or spaces, left between a long chamber containing the metal and the die, or through a space in the die, the said die being equal in length to the width of the intended sheet or sheets, and having its ends guided by, and working in, a corresponding chamber, containing the metal to be formed into sheets, substantially as described. I also claim, in combination with the ram, die, and chamber, the end guides, that guide the ram in its movements, and separate the lead from the ends of the chamber, and prevent it from being forced in between the ram and the chamber to choke the machine, substantially as described."

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15. For an *Improvement in Reaping Machines;* Obed Hussey, Baltimore, Maryland, August 7.

The patentee says,—"The improvement for which a patent is now asked, is fastening the upper piece of the guard to the lower piece only at the point, leaving the back end unconnected; consequently the space between the lower and upper pieces of the guard, through which the blades vibrate, is open behind, so that the grass, &c., which is forced in, by the action of the blades, now passes freely out through the opening; which opening, when used in combination with vibrating blades,

constitutes a claim in this improvement. My improvement extends also to the prevention of the accumulation of grass, &c , under the blades."

Claim.—"I claim the opening above the blades, in combination with vibrating blades. I also claim the particular application of the flush edge at the fork of the blades, for the purpose described."

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16. For an *Improvement in Harvesting Machines;* Martin Butts and Laurett Church, (administrators of the estate of Damon A. Church and others,) Friendship, Allegheny county, New York, August 7.

The patentees say,—"It has been found that the knives, although made and joined together with the utmost care, eventually become open in the joint, lose their interior cutting angle, and admit the fibres of vegetable matter between them. This difficulty is obviated by constructing the knives so as to be solid in that part."

Claim.—"What we claim as new, and desire to secure by letters patent, is the forming such knives solid at their inner angles as described."

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17. For an *Improvement in Water Wheels;* William Lamb, Rome, Oneida county, New York, August 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the above described horizontal water wheel, in combination with the method of introducing water thereto, viz: by a curb connected with, and forming part of a wheel, to save and give direction to the water, and the form and position of trunk noses, as herein described."

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18. For an *Improvement in Combining a Rocking Chair and Fan;* Charles Horst, of New Orleans, Louisiana, August 7.

Claim.—"What I claim as new, and desire to secure by letters patent, is the placing the fan in a frame secured to the back of the chair, and projecting over the seat of the same, combined with the cords and base pieces, (or a platform,) to which the rockers are connected, in such a manner that the vibration of the chair on its rockers, will impart motion to the fan, substantially as set forth."

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19. For an *Improvement in Fire Grates;* William H. Pulver, Troy, Rensselaer county, New York, August 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of dividing the grate into compartments, by means of serrated or interlacing bars or teeth, having an oscillatory or semi-revolving motion with the transverse bars, of which they form a part, or to which they are united; and this in combination with the rock shaft, through which the said motion is propagated from the lever."

20. For an *Improvement in India Rubber Shoes;* Robert Story and Thomas Hopper, New Brunswick, Somerset county, New Jersey, August 7.

The patentees say,—"The nature of our invention consists in preparing the shoes. Metallic rubber gum is manufactured from a compound of India rubber, sulphur, litharge, and camphene. The metallic gum for the manufacture of shoes, is cut and fitted on lasts of various sizes; the bottoms receive a sole and heel of cloth, prepared with the metallic gum on the inside, for the purpose of adhering to the shoe, in the process of curing in the heated chamber. And when the shoe is cured, the fitted parts become perfect, and form a shoe ready for the adaptation of the leather sole."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the attaching leather soles to metallic rubber shoes, by means of a sole and heel of cloth, prepared with metallic gum on the inside, for the purpose of adhering to the shoe, in the process of curing in the heated chamber, and when cured, they are ready for attaching the leather sole and heel as named."

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21. For an *Improvement in Lighters for Vessels;* Henry Stanton, City of Washington, D. C., August 14.

The patentee says,—"The nature of my invention consists in constructing the sides of the boat straight from bow to stern, for the purpose of giving the required strength, when this is combined with projections on each side, towards the bow and stern, for the purpose of making recesses at each side, to receive air-tight bags called "safety spars," made of India rubber cloth or other appropriate substance, the bags being protected from the injurious effects of snags, floating wood, &c., by these projections; and also in making the boat with beams passing entirely through the boat, and projecting sufficiently beyond each side, to receive and guard the safety spars which are attached to them, so that the whole strain in lighting or floating a steamboat or other vessel, shall be mainly borne by these beams instead of the body of the boat."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the boat with the sides of straight truss frames, connected with the bottom by means of the knee timbers, that lap on to each other in the middle of the boat, and secured to the keelsons and bottom by the interposition of cross timbers, substantially as described, (whereby great strength and stiffness is given to that part of the boat which has to sustain the strain as described,) when this is combined with the safety spars or floats, for giving additional buoyancy, as described.

"Secondly, I claim constructing the boat so as to be more buoyant towards the bow and stern than along the middle sections, by carrying out the sides, towards the bow and stern, beyond the truss frames that constitute the sides of the narrow part, in combination with the mode of constructing the frame of the boat, and with the auxiliary floats or

safety spars, which give the required buoyancy to the narrow part, substantially as described, the projections towards the bow and stern answering the double purpose of giving the required buoyancy at the ends, and protecting the auxiliary floats or safety spars, as described.

"And finally, I claim, in combination with the safety spars, making the guards to which the safety spars are to be secured, by passing the beams through the side frames, and below their upper edge, in combination with the mode of giving the required strength to the connexion of these with the boat, by bolting the beams to the top of the outside knees, and to the sides of the inside knees, the inside and outside knees being connected together substantially as described; whereby the required strength is given to the guards to resist the upward force of the safety spars."

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22. For an *Improvement in Packing and Pressing Cotton;* Mary Ann Mead, administratrix of James Mead, Aurora, Dearborn county, Indiana, August 14.

The patentee says,—"The main feature of my invention consists in an arrangement for pressing cotton into a uniformly dense mass, as it is gathered, by small increments round a spindle, more effectually, and with much less expenditure of power than is commonly employed to press the whole bale at once."

Claim.—"What I claim as new, and desire to secure by letters patent, is the apparatus for forming a bale of cotton, under pressure, on a spindle or revolving rod; but I do not intend, by this specification, to limit myself to the precise arrangement herein described, so long as I attain the same end by equivalent means."

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23. For an *Improvement in Casting Ordnance, &c.;* Thomas J. Rodman, Fittsburg, Allegheny county, Pennsylvania, August 14.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the cooling from the interior of the guns, or other heavy hollow castings intended to resist a central force, by circulating within the core a cooling fluid or gas, in combination with the application of artificial heat at the exterior of the flask, to prevent cooling from without."

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24. For an *Improvement in Planting Machines;* Richard Craggs and Oliver Reynolds, Webster, Monroe county, New York, August 14.

The patentees say,—"Our essential improvements are three in number, and are deemed indispensable to the proper action of the machine, namely:—1st, The addition of the revolving breaker, for breaking the manure in the manure box. 2d, In making the drills with round points, for going over stones, stumps, and other obstructions, with facility. 3d, In a new mode of arranging the cultivators on separate beams, between the drills, so that they shall move independently of each other."

Claim.—"What we claim as our invention, and desire to secure by

letters patent, is, 1st, The revolving manure breaker and pulverizer, when placed in the front part of the hopper, and in front of the revolving conveyor, in combination with the manure box or hopper, substantially as herein described, whereby the manure is broken, pulverized, and worked to a suitable degree of fineness for being conveyed into the jointed conducting tube, along with the seed to be planted; thus dispensing with the services of the attendant, whose duty has heretofore been to agitate and break up the manure in the hopper with a fork, or other implement, and discharge the same into the concave of the revolving conveyor, during the progress of the machine. 2d, We also claim the particular form of the front or cutting part of the drill, as combined with a separate adjustable jointed beam and conducting tube, passing through the same."

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25. For an *Improvement in Drying Grain, Flour, &c.;* James R. Stafford, Cleveland, Ohio, August 14.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the method of drying or cooling grain, flour, meal, or other substances on the external surface of a hollow cylinder, armed with flanches, or other devices, arranged and operating substantially as described, and combined with a trough—the cylinder to be filled with hot air when used for drying, and with cold air when used for cooling purposes as set forth.

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26. For an *Improvement in Cooking Apparatus;* B. Antognini, New Orleans, Louisiana, August 14.

Claim.—" What I claim as my invention, and desire to secure by letters patent, are the following parts: 1st, The division of the cover, or upper surface of my furnace, into several parts, each of those parts bearing one furnace. 2d, The use of partitions which isolate each furnace, and, in combination therewith, the use of the little door of each furnace, which partitions and doors govern the fire as required; thereby presenting all the advantages of the chimney, or of the smoke apparatus, without their nuisance, owing to the use of charcoal."

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27. For an *Improvement in Wool Burring Machines;* Francis A. Calvert, Lowell, Middlesex county, Massachusetts, August 14.

The patentee says,—" By my improvement the saw guard cylinder is made entirely solid, or in one piece, and the teeth are shaped or cut on the same, so as to operate more effectually in cleaning out the burs, and less injurious on the staple of wool or other fibrous material."

Claim.—" What I claim as my invention, and desire to secure by letters patent, is a saw guard cylinder, made in one solid piece, with the teeth and grooves shaped and set spirally, substantially as herein set forth."

28. For an *Improvement in Coupling Line Shafts;* E. M. Rice, Worcester, Worcester county, Massachusetts, August 14.

The patentee says,—"The nature of my invention consists in coupling shafts by means of a ring that fits over the periphery of the two flanches, disks, or plates, on the end of the two shafts, the ring being provided with longitudinal feathers, to fit corresponding grooves in the periphery of the two flanches, disks, or plates; so that, by simply sliding off the ring, the two are disconnected, and in this way any section of a shaft can be taken out without the necessity of moving the remaining portions of the shafting, as the projection of the one into the other is entirely avoided, when this is combined with the mode of clamping together the two disks, by means of screws that pass from a flanch of the ring that rests against one of the disks, and tapped into the other disk, one of the disks being thus clamped between the flanch of the embracing ring and the other disk, the screws passing through the parts, and being tapped into the other, or screw bolts passing through the three, with nuts outside."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of coupling shafts by means of the circular flanches, disks, or plates, on the ends thereof, and grooved or feathered on their periphery, on lines parallel with a ring which fits on the periphery of the flanches, disks, or plates, substantially as described, in combination with the mode of clamping the two disks by screws passing through the two disks, and the flanch of the embracing ring, whereby the projection of one shaft into the other, as a means of pressing them in the same central line, is obviated, as described, and, at the same time, the two shafts are clamped together endwise, to prevent sagging and wabbling, as described."

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29. For an *Improvement in the Steering Apparatus;* Jesse Reed, Marshfield, Plymouth county, Massachusetts, August 14.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of an endless screw and its nut, arranged as described, so as to move longitudinally forward and back, with the button connected to the rudder head, or a cap on the same, and the curved arm connected to said head or cap, and to the nut, all as above set forth, and the arrangement of said parts as above described, so as to have but one bearing extraneous to the rudder post, and thereby permit said post to rise without breaking or deranging the apparatus, and also any mechanical devices substantially the same, and combined substantially in the same manner, for forming a steering apparatus."

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30. For an *Improvement in Casting Door Plates;* J. A. Pease, Philadelphia, Pennsylvania, August 14.

The patentee says,—"The nature of my invention consists in the combination and arrangement of a mould, and a movable set of letters of the alphabet, or types, cut with a bevel on each side, in order to

keep them from slipping out of their places, and for the purpose of casting door plates, &c., in one solid piece, with the name sunken into the face of the plate, said letters or types serving as a matrix, and are raised, for said purpose, above the surface of the groove at a suitable height."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of a mould and the letters of the alphabet, as described, for the purpose of casting door and other plates, with the letters or name sunken in the face of said plate, and said plate, when cast, together with said letters, to be cast in one solid piece, and in one operation."

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31. For an *Improvement in Boot Patterns;* Simon C. Shive, Bloom township, Columbia county, Pennsylvania, August 14.

The patentee says,—"The nature of my invention consists in combining several plates of metal, or other material, one with another, in such a manner, so that when thus combined, they will form a boot pattern which can be adjusted, at one operation, to any required size, by means of the simultaneous and proportional extension of the several parts."

Claim.—"What I claim as new, and desire to secure by letters patent, is the adjustable character of the patterns at one operation, or, in other words, the simultaneous and proportional extension of the several parts composing them, arranged in the manner, and for the purpose herein set forth."

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32. For an *Improvement in Rivets for Leather Bands;* F. W. Wood, City of New York, August 14.

Claim.—"I claim as my invention the application of rivets, so formed in the head, conjointly with a feather-edged burr, having a concave or dished face, with a conical hole, to receive the clench, and finish the rivet flush with the faces on both sides of the band, substantially in the manner set forth."

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33. For an *Improvement in Riveting Leather Bands;* Wm. H. Jenison, assignor to Wm. Kumbell, City of New York, August 14.

The patentee says,—"The nature of my invention consists in making the head of the rivet concave, and the shank oval."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the above described form of rivet, in combination with, and for the purpose of, uniting leather belts, substantially as described, which I call the concave head and oval shank rivet."

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34. For an *Improvement in Baskets;* Abraham Van Riper, Washington, Bergen county, New Jersey, August 21.

The patentee says,—"The object of my improvement is to prevent the bottoms of fruit baskets from sinking or falling down. This I effect by introducing two hoops, of about $\frac{1}{4}$ of an inch thickness—the

one on the bottom of the inside of the basket, and the other on the bottom of the outside of it. These hoops are connected by rivets or nails, and thereby securing between them the standards of the basket."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of two hoops, fastened together by nails or rivets, so as to enclose the standards which form the arched bottom of the basket, and prevent them from yielding or falling down, by the pressure of fruit, &c., which the basket may contain."

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35. For an *Improvement in Cooking Ranges;* Samuel Pierce, Troy, Rensselaer county, New York, August 21.

The patentee says,—"The nature of my invention consists in heating the oven or ovens, by means of currents of air, which are heated in passing through chambers surrounding the fire place, and which, after passing through the oven or ovens, are discharged into the closed ash pan, to supply the combustion in the fire chamber."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is heating the oven or ovens, by the passage through it or them, of a current or currents of air, heated on its or their way to the oven or ovens, by passing through chambers surrounding the fire chamber, substantially as described; when this is combined with the discharge of the current or currents, from the oven or ovens, into a closed ash pit, to supply the combustion in the fire chamber as described; whereby the combustion insures the passage of the current or currents, through the oven or ovens, substantially as described."

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36. For an *Improvement in Setting and Filing Saws;* Charles Lafferty, York Springs, Adams county, Pennsylvania, August 21.

The patentee says,—"The nature of my invention consists in the construction and arrangement of the clamp for holding the saw for setting and filing, and in combining therewith, a guide for the file, and a gauge and tool for setting the teeth."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing a saw set in the manner described, by having one jaw raised above the other, and beveled on the face, with a rib behind, as described, by which the teeth are set by a toothed lever, that hooks over said rib, and brings the tooth against the teeth of the saw as specified—the width of the set of the teeth being determined by the gauge, substantially in the manner and for the purpose set forth. I also claim the filing apparatus, constructed substantially as herein made known, consisting of a file holder, consisting of a standard that slides parallel in front of the jaws of the clamp, to which the file is so attached as to have a free motion, horizontally, in any direction to which it is set, and so regulated as to file to any given depth the holder is set for, so that it will direct the file to the proper angle and depth on the saw, in the manner and for the purpose above specified."

37. For an *Improvement in Winnowing Machines;* Jacob Behel, Mifflintown, Juniata county, Pennsylvania, August 21.

Claim.—"What I claim as new, and desire to secure by letters patent, is the forming a series of shoulders, one above another, on the inclined board forming the bottom of the hopper, in combination with the reciprocating longitudinal movement of the same, for the purpose of regulating the feed from the hopper, substantially as herein set forth. I also claim the combination of the separator shaft with the shoe, and with the pitman, by means of the crank and vertical pitman, for the purpose of imparting to it a reciprocating horizontal movement, and a vibratory movement on its axis at the same time, substantially in the manner, and for the purpose herein set forth. I also claim the combination of the screen and the slats with the apron, substantially in the manner and for the purpose herein set forth."

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38. For an *Improvement in Machinery for Rasping Dyewoods;* C. W. Roberts and John Hambly, Philadelphia, Pennsylvania, August 21.

The patentees say,—"The rasping wheel in our machine is composed of a series of circular saws, secured to a shaft in such a manner as to give them an oblique inclination to the same, so that, as they are revolved, the rasping action of the saws will operate on the wood, to the right during one half of the revolution of the saws, and to the left during the other half. By means of this arrangement of the saws, they can be placed at a very considerable distance from each other, and yet their teeth will operate upon the entire surface of the substance placed in contact therewith."

Claim.—"What we claim as new, and desire to secure by letters patent, is the constructing the rasping wheel of a series of parallel circular saws, secured to the shaft in an oblique position thereto, so that their rasping action will operate on the wood, to the right during one half their revolution, and to the left during the other half, substantially in the manner and for the purpose set forth."

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39. For an *Improvement in Window Blind Fasteners;* James M. Evarts, New Haven, Connecticut, August 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of attaching the spiral spring to the catch by a pin or bolt, extending through the whole length of the spiral spring, from the projection to the hole, and thus securing the spiral spring in its proper position, so that it may work freely, be secured from liability to get cramped, and prevent it from being thrown out of its place by any accident; the whole being constructed and operating as set forth."

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40. For an *Improvement in Manufacturing Lead Pipe;* Samuel G. Cornell, Greenwich, Fairfield county, Connecticut, August 21.

The patentee says,—"My invention consists of certain improve-

ments in the arrangement and combination of the machinery or apparatus heretofore used for similar purposes, and in the construction and application of certain additional machinery or apparatus, and the combination thereof with the other apparatus as described."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing the die for forming the interior surface of the pipe, in the piston or hollow mandrel, as the case may be, substantially as described, instead of placing it in the head of the lead cylinder, as has been heretofore done; so that as the piston is forced into the cylinder, or the cylinder forced over the piston, the pipe will be formed at the point of pressure, without moving the mass of lead relatively to the cylinder; and, in combination therewith, I claim the cores for forming the interior surface of the pipe, the die and core being adjusted and held in their proper relative positions by any of the known methods."

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41. For an *Improvement in Safety Apparatus for Steam Boilers;* Timothy Clark, New Haven, Connecticut, August 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of an elastic vessel as described, instead of the piston, whereby the friction of the piston is avoided, and the operation on the damper rendered much more uniform; the whole constructed and operating substantially as herein described."

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42. For an *Improvement in Fishing Hooks;* Stanton Pendleton, New Haven, Connecticut, August 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the attaching of the common fish hook to the 'spring fish hook,' (claimed to have been invented by Griswold, as the 'sockdologer hook,') patented by Englebrecht & Skiff, by means of a screw spring and catch, or any other convenient method, so as to be readily attached, detached, or changed at pleasure, in manner and form substantially as described."

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43. For an *Improvement in Fishing Hooks;* Job Johnson, Brooklyn, Kings county, New York, August 21.

Claim.—"What I claim as new, and desire to secure by letters patent, is the original application of the stock or frame piece, the original application of the helical contractile spring, together with the original constructive arrangement of the parts, for these purposes, conjointly with a crooked and barbed dart, acting through the cock pin, trigger lever, and contractile helical spring, to strike the fish or animal, by disengaging the dart from the trigger, through the combined action of the changeable hook with and upon the foregoing parts; the whole constructively arranged and combined to strike the fish or animal, biting at or touching the bait on the hook, the whole effected without any action of the line, or of the person holding the line, substantially as described.

"I also claim the application of the guard ring, to protect the user from injury, by the dart accidentally disengaging while setting the bait for use."

44. For an *Improvement in Thinning Cotton;* Elijah M. Morris and James Cleghorn, Cartersville, Cass county, Georgia, August 21.

The patentees say,—"The nature of our invention consists in the application of the axletree and wheels to the thinning of cotton."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the handles with the axle and hoe frame, as described; the handle and hoe frame being independently attached to the axle which forms the fulcrum, and the relative position of the handles and hoe frame being adjustable, the handles are converted into adjustable levers for elevating and depressing the hoes."

45. For an *Improvement in Cooking Stoves;* P. Whiteside, Weedsport, Cayuga county, New York, August 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the diving flues at the back, in combination with the horizontal flues between the top and bottom ovens, and the two dampers in the diving flues, substantially as described, whereby the draught can be carried under the top oven, independently of heating the lower oven, when it is desired to use the top oven alone, as described. Second, the placing a partition in the main return flue, to turn the draught from the two side flues, and prevent them from acting against each other, or uniting to impede the draught until after they have been thrown in the direction of the main return flue, substantially as described."

46. For an *Improvement in the Mode of Heating Wheel Tires;* Alva Gregory, Pike, Wyoming county, New York, August 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the invention of a circular furnace for heating carriage tires, by confining the heat as described; and in carrying out that principle, I do not intend to limit myself to any particular materials or dimensions in constructing the furnace, whilst I attain the same end by substantially the same means."

47. For an *Improvement in Cooking Stoves;* Nathaniel Bosworth, Jr., Troy, Rensselaer county, New York, August 28.

Claim.—"What I claim, and desire to secure by letters patent, is dividing the space between the front of the fire box and the front of the stove, vertically into three portions, the two outer communicating at the bottom with the flue beneath the oven, and connected at the top by a horizontal cross flue; while the middle portion or space between these latter, constitutes a flue for the furnace in the sunk hearth, communicating by a damper with the cross flue before mentioned,

and through this latter with the smoke pipe, and serving, likewise, to receive and heat the current of external air before it passes beneath the grate of the fire chamber. And in combination with the foregoing, I also claim the manner in which (by the arrangement of the register in front of the hearth plate, and the interior plate forming the passage) I introduce the draught of external air, both to the hearth furnace and principal fire chamber."

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48 For an *Improvement in Mills for Grinding Mustard, &c.;* Chas. Walker, Brooklyn, New York, August 28.

The patentee says,—"The nature of my invention consists in the construction of a machine or mill for pulverizing mustard seeds, grain, drugs, and other like things, especially gummy or oleaginous substances; the peculiar properties of said machine or mill being rapidity of action, without becoming clogged with the matters it pulverizes, no matter how sticky their nature."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar combination of the segments with one another, to form a ring of wood, so that the ends of their fibres shall make the wearing surface for the purpose herein described. Also the combination of the movable partition and block with the balls and the ring, in manner and for the purpose set forth."

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49. For an *Improvement in Curry Combs;* John Jones, Bristol, Hartford county, Connecticut, August 28.

The patentee says,—"The nature of my invention consists in making a piece of sheet metal of either brass or iron, the width of said sheet is the width of the curry comb, said sheet is slitted or slotted out, to admit of the rows of teeth in the comb to pass through the sheet metal between the slots being left and occupying the space between the rows of teeth, one end of said sheet is jointed or hinged to the comb, on the other end is a spring for fastening it to the back of the comb when used. It must be evident to all, that as the teeth pass through the narrow slots, if they become filled up, while the cleaner is below their points, they will be entirely freed from dirt when the cleaner is raised up; this being done, the cleaner is replaced again and ready for use."

Claim.—"What I claim and desire to secure by letters patent, is the combination of the cleaner as herein described, or any other substantially the same, with the curry comb, substantially in the manner and for the purpose set forth."

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50. For an *Improvement in Apparatus for Retarding the Motion of Wheel Carriages, called the "Self-Acting Brake;"* Christian Stoner, Gettysburg, Adams county, Pennsylvania, August 28.

The patentee says,—"The nature of my invention consists in so modifying and applying E. Slifer's apparatus for the above named purpose, patented in 1826, as to render it practicable and useful for the purpose intended, and imparting to the apparatus, by a peculiar

mode of combining and arranging the several parts, a quality not heretofore possessed by it, or any other apparatus for retarding the motion of wheeled carriages, namely, that of causing the levers and spring to act simultaneously in drawing the rubbers against the peripheries of the wheels, whilst the carriage is moving forward, by its momentum and gravity, at a greater speed than that of the horses, and to throw the rubbers from the wheels when the motion of the carriage has become reduced; also, in keeping the central connecting rod extending from the lever at the end of the pole to the branches that connect with the L shaped levers, parallel with the centre of the pole and perch, during the operation of turning the carriage."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The manner of retarding carriages in descending hills, by the combination of the crossed levers, cranks, parallel connecting rods, and springs, arranged and operated in the manner set forth. 2d. I likewise claim making the rod to retain its central position beneath the pole or perch and tongue, whilst turning the carriage in the manner described, by having an oblong link formed in it at the coupling bolt, in the manner above set forth, by the combination of the triangular plates and short rods."

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51. For an *Improvement in Tanning Hides or Skins;* Alexander Turnbull, Surrey county, Kingdom of Great Britain, August 28.

The patentee says,—"The nature of my invention consists in the adaptation of a newly discovered law, called Endosmosis and Exosmosis, to the tanning of hides and skins, and also in the use of sugar, or saccharine matter of any description, for the purpose of extracting the lime from hides and skins before being tanned."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, First, The discovery of the means of extracting the lime with which the hides and skins are impregnated, in removing the hair by the use of sugar or any other saccharine matter, whether obtained from the sugar cane, honey, beet root, turnips, potatoes, the maple tree, or any other vegetable substances.

"Second, I claim the discovery of the application of the law of Endosmosis and Exosmosis to the purposes of tanning, with the materials and in the manner before described, or in any way wherein the hide or skin can be placed between the fluids containing tannin or tannic acid of different specific gravities."

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52. For an *Improvement in Cooking Stoves;* Samuel Shreve, Burlington, New Jersey, August 28.

The patentee says,—"The invention and improvement I have made consists in a new arrangement of some of the flues and dampers, with others of the ordinary arrangement, for the purpose of applying the heat to the ovens in a more advantageous manner, to produce a more regular heat in the same, by a reduced consumption of fuel, and in having a more complete command over the dampers in changing the

direction of the heat, so as to apply it to any particular part of the stove that may require to be heated; and also for shutting off the draught through the same, and confining the heated gases therein, for the purpose of keeping the ovens at a proper degree of heat when not required to bake quickly."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The arrangement of the dampers, in combination with the flues for converting these flues and other flues into hot air chambers, in the manner and for the purpose set forth.

"2d. I claim arranging the smoke pipe near the bottom of the stove, in combination with the additional flue, arranged between the flue and the ovens as described.

"3d. I claim the manner of combining the two front corner flues with the broad transverse flue beneath the hearth plate as described."

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53. For an *Improvement in Mills for Grinding Corn in the Cob;* Amory Fisher, Tuscaloosa, Alabama, August 28.

Claim.—"What I claim as new, and as an improvement on that patented by James Miller, is the combining of the knives or crushers with the mill stones, in the manner set forth, the upper stone being stationary, and being provided with a feeding opening or openings, and a cutter or crusher, situated in the cavity made in said stone, to admit the revolving knives affixed in the stationary stone; these parts being combined, arranged, and operating, in the manner and for the purpose set forth. I also claim the manner of arranging the hoops in such a mill, in order to insure the ready delivery of the ground stuff. I do not claim either of the devices in my first claim individually, but I do claim them in their combination, as producing the useful results herein made known."

List of American Patents which issued in the month of November, 1842, with Exemplifications, by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Gas Meters;* John Hemming, North Bank, Middlesex county, England, November 4.

The patentee says,—"My improvement consists in a self-acting apparatus, for maintaining the liquid in the gas meter at a uniform altitude, in the employment of a liquid that does not freeze at the ordinary temperature of freezing water, and in protecting the metals composing the meter from voltaic or chemical action."

Claim.—"I claim the construction of the gas meter with a supply cistern attached to it, and a tube for conducting liquid from said cistern to the meter, the latter having a syphon connected with it, for the purpose described, the whole being constructed, arranged, and operating in the manner set forth."

2. For an *Improvement in Strabismus Goggles;* Andrew Lake, Flat Bush, Kings county, New York, November 4.

The patentee says,—"The nature of my invention consists in an instrument which is worn by the patient, shaped somewhat like a pair of goggles; which is so constructed that the patient turns the affected eye, when looking at objects, in a direction directly the opposite to that which it takes when in the act of squinting."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of curing strabismus or squinting, by causing the patient to see objects directly opposite to that which it takes when in the act of squinting, whether by the above described instrument or any other the same in principle."

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3. For an *Improvement in the manner of combining an apparatus for Disengaging Horses from Carriages, and of Arresting the Motion thereof;* Jacob Harlecker, Lancaster, Lancaster county, Pennsylvania, November 4.

The patentee says,—"For the purpose of disengaging the horse or horses, in case of their running away, I so connect a strap or line with two spring bolts, by the outer end of which the traces are held, as that the driver, by drawing upon said strap or line, may retract the bolts, and liberate the horse or horses from the shafts, and may also raise and hold up the shafts, so as to prevent their falling and coming in contact with the ground. For the purpose of arresting the motion of the carriage, I place a lever along the perch of the carriage, which lever is so constructed as that its rear end shall form a forked drag, which may be brought into contact with the ground, by drawing upon the opposite end of the said strap or line, or of a separate strap or line attached thereto."

Claim.—"I claim the combining with such disengaging apparatus the lever drag and its appendages, arranged and operating substantially as herein set forth."

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4. For an *Improvement in Boots and Shoes;* John Dick, Philadelphia, Pennsylvania, November 4.

The patentee says,—"My improvement consists in the inserting of an elastic metallic shank, made of thin sheet steel, or of a plate of other elastic metal, between the out and insole of the boot or shoe, which elastic shank is to extend from the ball of the boot or shoe to within about a fourth of an inch of the heel ran."

Claim.—"What I claim as new, and as constituting my invention, is the insertion of elastic metallic shanks, formed and applied substantially in the manner herein set forth, between the insole and outsole of boots, shoes, and pumps, of all descriptions, to which they can be applied."

5. For an *Improvement in Manufacturing Axes;* Isaac W. Turner, Baltimore, Maryland, November 4.

The patentee says,—"The principle consists in the employment of dies or swedges. The metal being prepared and placed in said dies, is subjected to a welding and condensing pressure, either by a drop, a screw, a roller, or a wedge pressure."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of forcing or hugging the pieces of dies up together horizontally on the anvil, by the levers and straps, and the fulcrums, whilst the top piece of the die, attached under the drop or pressing hammer, is forcing downwards, as before described, for the purpose of constructing axes and other tools."

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6. For an *Improvement in the Machine and Process of Blowing or Cleaning Furs;* John W. Cochran, City of New York, November 4.

The patentee says,—"The invention or improvement claimed is, First, The obtaining on this plan a passage way or fur duct, of sufficient length to perfect the separation of the hair from the fur in one operation, and the extension of it to any required length, in an ordinary sized room, by increasing the number and length of the flues.—Second, The process of coating the flues by the use of water, as well as any adhesive substance, to catch and retain the hair as described, instead of the cloth covering now generally used for that purpose,—the value of this part of the improvement being the facility with which the coating is obtained, and the saving of time and labor. And, lastly, that, by the draught or suction caused by the blower, the fur can be drawn through the openings, (or some other convenient place,) direct from the breaker or cutting machine, into the wheel house, by means of a flue or conductor."

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7. For an *Improvement in Lamps for Volatile Materials;* Augustus V. H. Webb, City of New York, November 4.

The patentee says,—"The nature of my invention consists in obstructing the passage of liquids, by means of an air tight stop cock, or other apparatus substantially the same, attached between the floor of the fountain or reservoir, and the burners, thereby preventing the liquid from flowing into and finding its level in the burner; the obstructing cock or apparatus being so constructed as to enable the operator to graduate the stream or quantity of liquid admitted from thence to the burner, in just such quantities as the construction or dimensions of the burner, or the nature of the liquid to be burned, may require."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of regulating the flow of the oil, or other inflammable liquid, to be consumed in the lamp, in combination with the burner without a wick, as described, for producing the light; whether constructed in the manner above set forth, or in any other mode substantially the same, for affording artificial light."

8. For an *Improvement in Composition for Preserving Leather;* T. P. Merriam, New Bedford, Bristol county, New York, November 4.

The patentee says,—"Supposing the whole composition to be divided into equal parts by weight:—I take about six parts of logwood, five of oak and hemlock bark, and these I boil in a sufficient quantity of water for two or three days, so as to make a strong decoction, which I strain off. I then take two parts of Bristol lustre, or black lead, two parts of copperas, and two parts of nutgalls, and boil these together, strain the mixture, and add it to the former decoction. I next boil together about two parts of neat's-foot oil, two parts of olive oil, one part of linseed oil, and one part of beeswax, which I add to the mixture as before, together with about one part of spirits of turpentine, one part of aqua ammoniæ, and four or five parts of soap. This constitutes the whole mixture or compound."

Claim.—"What I claim, therefore, as my invention, and desire to secure by letters patent, is the preparing of a compound for the preserving and renovating of leather, which shall consist generally of the ingredients herein designated, with only such variations as will leave it as a whole, substantially the same with that herein fully made known."

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9. For an *Improvement in Paddle Wheels or Propellers;* A. R. Chase, Cincinnati, Hamilton county, Ohio, November 9.

Claim.—"I do not claim to be the first who has applied a gearing of cog wheels and pinions, to regulate and determine the manner in which the buckets shall dip into and leave the water; but what I do claim, is the effecting of this object by the attaching of the wheel to the shaft of the paddle wheel, and the combining of the same with the regulating wheel, by means of the small wheels or pinions, and the regulating wheel being also made to drive the pinions on the shafts of the buckets, the whole apparatus being arranged and operating substantially as herein set forth."

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10. For an *Improvement in an Apparatus to Prevent Steam Boilers from Bursting;* Thomas S. Easton, Mobile, Alabama, November 9.

The patentee says,—"The nature of my invention consists in a steam chest placed within the boiler, and on top of the flues or flue, if a flue boiler; if the boiler is without flues, the steam chest is secured to the shell of the boiler, on a stand that will lift it above the water line."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a steam chest within the boiler, provided with a pipe to carry off the steam, and a valve in its upper part, opening downwards, for the purpose and in the manner described. I also claim the feeler, in combination with a valve within the boiler, for the purpose of opening the valve from without the boiler, as described."

11. For an *Improvement in Making Cassimere Hats;* Oliver Brooks and J. A. Sloan, Philadelphia, Pennsylvania, November 9.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of making cassimere hats, by constructing an outside seamless cover, made of wool, or other material of which wool is a component part, to fit and be attached to a previously formed shell or body, constructed in the usual manner; the whole to be effected in the manner described, or in any other substantially the same."

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12. For an *Improvement in Padlocks;* E. H. Roper and W. Ball, City of Washington, D. C., November 9.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the construction of our tumblers in such a form as to be on a balance on all sides of the pin, and in their having rotary motions in different directions, which prevents them from being affected by a blow to open the lock, and further, in their being so constructed as to pass each other where the key enters, and thereby cut off all possibility of a pick being used to open the lock."

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13. For an *Improvement in Setting Teeth;* M. S. Foster, Trenton, Mercer county, New Jersey, November 12.

The patentee says,—"The nature of my invention consists in soldering a strip of gold or silver, of the thickness of a half-worn sixpence, and an eighth of an inch in width, more or less, to the outer edges of the superior and inferior plates of gold or silver, designed and prepared to have incorruptible teeth, with artificial gums, fastened upon them; which teeth are usually made in three sections to each plate for whole sets, but varying with some dentists, from a single tooth, to two, making seven sections to each plate when completed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the plate upon which the artificial teeth, with gums, are to be fastened, with the flange or turned edge, for the purpose of adding strength to the arch, and preventing the introduction of secretions between the joints."

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14. For an *Improvement in rendering Metallic Roofs Water Tight around the chimney and dormer windows;* Jno. U. Boesch, Charleston, South Carolina, November 12.

The patentee says,—"To render the joint at the junction of the roof with the chimney, dormer window, or other projection, secure against leaking, take a sheet of copper, or of whatever metal the roof is to be composed, longer than the width of the chimney, and turn up the edge next the chimney, about 8 or 10 inches, more or less, so that the surface shall be parallel with the outer surface of the chimney; then turn up the ends of the sheets at right angles to the roof; then lap the part of the sheet that folds at the corners, against the first described

turned up edge, or against the side of the chimney as specified, and secure the same."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of rendering the joints at the junction of the sheets of metal, secure against leaking around the chimneys and dormer windows, by bending and scolloping the sheets, in combination with the double lapping of the joints as described."

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15. For an *Improvement in Stoves;* Philetus Phillips, Middletown Point, Monmouth county, New Jersey, November 12.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner of constructing the hearth or bottom of the fire chamber, having, for the purpose of compressing and strengthening the draught, and bringing it more immediately in contact with the ignited fuel, an aperture, or apertures, extending nearly or quite through the middle thereof, lengthwise of the wood to be placed thereon, having on one or both sides of said aperture, or apertures, a space for the retention of the ashes, to preserve the coals for the renewing of the fire.

"I claim also, in combination with said aperture, or apertures, the inclination of the hearth on the side or sides thereof, to give the fuel and ashes a tendency thereto, and to bring the greatest bulk or depth of fuel directly over said aperture or apertures.

"I claim also, the method herein described, of making the upper section of the fire-brick, or other lining, having an aperture, or apertures, in the top of it, for the direct upward passage of the heated air and smoke, connected with a damper, or valve, to close said aperture, or apertures, to cause the heated air to pass out at the lower edge of said upper section. I claim also, the connexion of said lower edge of the upper lining with the fire-brick, or other material, forming the lower section or hearth, in such a manner as to leave a space of half an inch, more or less, between them for the outward passage of the smoke and heated air.

"I also claim the method herein set forth, of directing the draught downwards, by a plate or plates of cast iron, or other material, of cylindrical or other form, closely connected with said lower edge of the upper lining, to prevent the upward passage of the smoke and heated air, on coming to said edge, and to cause it to descend and pass from within said plate, or plates, near the lower part of the stove, and rise to the upper part thereof, between the lining and the material forming the outer surface of the stove.

"I also claim the exterior and lining of the stove, such as to cause the smoke and heated air, after leaving the chamber of combustion within the lining, to be formed into a thin stratum between them, that the heat may be thus the better radiated, as it rises to the upper part of the stove.

"I also claim the method of employing a lining of fire-brick, or other similar material, in respect to its properties as a non-conductor of heat, serving to form a passage for a stratum of heated air, as described.

"I also claim the combination of a door, designed, when shut, to

exclude the air as much as may be, with the aperture, or apertures, in the hearth as aforesaid, and a drawer underneath, to receive the ashes, and to regulate the admission of air for the purpose of combustion.

"I also claim the connexion of a series of apertures in the upper part of the lining, for the vertically upward passage of the smoke and heated air, extending in the direction of the aperture, or apertures, in the hearth as aforesaid, with a damper or valve having corresponding apertures, and which, being drawn or pushed in a right line, will open or close them all at once."

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16. For an *Improvement in a Machine to be used in combination with improved iron truss hoops, in the manufacture of barrels, and other coopers' ware;* J. H. Bruner and R. M. Thompson, Granville, Knox county, Ohio, November 12.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combining the inner frame, having rollers to receive and support the barrel, with the outer frame, by hinging one end of it to said outer frame, and suspending the other to the eccentric, for the purpose and in the manner described. We likewise claim the manner of combining and arranging the respective parts of the holder, consisting of its spindle, bow, revolving shaft, screw points, and sliding head, the whole being formed, and operating substantially as set forth. And lastly, we claim the employment, in combination with said machine, of iron truss hoops, made perfectly true within and without, and of such strength as to enable them to give their own curvature to the ends of the staves."

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17. For an *Improvement in Shingle Machines;* William Foster, Detroit, Wayne county, Michigan, November 21.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I regulate the throats of the knives, or cutters, and the thickness of the shingles, by means of circular gauges let into grooves in the table, and the straight bar to which they are connected; the circular gauges being held in place and adjusted by set screws, and serving as ways to sustain the bolts or blocks, the whole being formed and operating substantially as herein set forth."

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18. For an *Improvement in Lard Lamps;* John Lee, Wellsville, Columbiana county, Ohio, November 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the inner tube and piston, with the outer tube, constructed and arranged in the manner, and for the purpose herein set forth."

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19. For an *Improvement in Purifying Animal Oils;* Alfred Traband, City of New York, November 21.

Claim.—"What I claim as my discovery, and desire to secure by

letters patent, is the mode of purifying animal oils, by means of the bi-chloride of mercury."

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20. For an *Improvement in Veneering Machines;* Casper Kittinger, assignor to William Iba, East Grenville, Ohio, November 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of forming a bed, on which to veneer curved surfaces, by means of slats provided with slots, through which clamp screws pass, to secure them in any position, by which the operator can adapt them to any desired curve, for the purpose and in the manner substantially as herein set forth."

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21. For an *Improvement in Tuyere Irons;* Richard Brewer, Plymouth, Richland county, Ohio, November 21.

The patentee says,—"The nature of my invention consists in forming my air box into three divisions, which I designate by the names of upper, lower, and back chambers. I connect these chambers with each other in such a manner as to produce a double re-action in the box, before it is allowed to escape to the fire."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of my air box into three chambers, connected with tubes, in the manner and for the purpose herein set forth."

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22. For an *Improvement in Cisterns for preventing water from freezing;* Joshua Woodward, Naverille, Grafton county, New Hampshire, November 21.

The patentee says,—"The principle upon which I proceed, in preventing the water supplied from freezing is, that the exhalations of air and vapor, which emanate from the ground at the depth of four or five feet, more or less, below the surface, according to the location, is at a temperature some degrees above the freezing point, and that such exhalation may be applied to the preserving of a corresponding temperature in a vessel containing water, and thus prevent its freezing."

Claim.—"What I claim as new, and desire to secure by letters patent, is the taking advantage of the temperature of the earth below the point of frost, and the temperature of the air or vapor emanating therefrom, by making an excavation in the ground, to a depth greater than that to which its temperature may at any time be reduced, to the freezing point, by covering said excavation as described, and by diverting and governing the emanation from the ground, so as to cause it to surround the water which is to be kept from freezing; the whole being effected by an arrangement of the respective parts of the apparatus or structure, substantially the same with that herein set forth and made known."

23. For an *Improvement in Boots and Shoes;* Joshua S. Bowler, Lynn, Essex county, Massachusetts, November 21.

The patentee says,—"This invention or improvement consists in combining and arranging three steel plates, or springs, between the soles of the shank of the boot or shoe, being of the same curvature of the soles, but of less size, each one being smaller than the next above, the plate next the inner sole being the largest, and the plate next the outer sole being the smallest, and the middle plate being of an intermediate size, and all of them being fastened together at the heel by a screw and rivets, and separated at the ends next the ball of the boot or shoe, where all the ends have a longitudinal play between the sole, the side or lateral movement being prevented by forming a projection or stud on each plate, and making corresponding mortises in the plates into which the studs enter."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the countersunk screw heel plate with the combined spring shank, constructed and arranged as herein described."

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24. For an *Improvement in Machinery for shaping the inner side or periphery of the felloes of carriage wheels;* Robert H. Henry, Barre, Worcester county, Massachusetts, November 21.

Claim.—"I claim the method of presenting the inner surface of the felloe section to the proper operation of the rotary curved knife—that is to say, by raising and depressing the curved carriage, during its progressive motion forward or under the cutting knife, by means of projections from the sides of said carriage, and grooves in the stationary side guiding plates, in which said projections move; the whole being arranged and operating substantially as described."

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25. For an *Improvement in Bee Hives;* E. Booth, Springfield, Massachusetts, November 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar manner of raising, lowering, and supporting the hive, by means of the hinges and pegs as set forth."

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26. For an *Improvement in Coal Sifters;* John J. Doane and W. H. Denny, City of New York, November 28.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the peculiar arrangement of the cylinders, in the form of a frustrum of a cone, in combination with the hopper, and the arrangement of the drawers, the whole combined substantially as set forth."

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27. For an *Improvement in Bee Hives;* Aaron Francis and John Carlisle, Chandlerville, Muskingum county, Ohio, November 28.

Claim.—"What we claim as our invention, and desire to secure by

letters patent, is making a bee hive with a vertical passage in the middle, communicating with the interior of the double ranges of rhomboidal sliding boxes, or bee drawers, for the passage of the bee thereto, for a free ventilation, and for preventing the entrance of moths, &c., in combination with the upper box, and the double inclined plane, ledge, or rest, as described."

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28. For an *Improvement in Hemp Machines;* J. C., G. W., & C. E. Geisendorff, Cincinnati, Hamilton county, Ohio, November 28.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the breast board, against which the hemp, &c., is borne when the beaters are in action, in combination with the feeding and discharging rollers as described."

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29. For an *Improvement in Steering Wheels;* Philip T. Share, Baltimore, Maryland, November 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the parts, consisting of the steering wheel, and its shaft and cog wheels, and the drums, and the gearing to drive them in different directions; and the construction of the tiller, all as described."

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30. For an *Improvement in the Self-Acting Brake for Inclined Planes;* Nathan Smith, Waterloo, Sussex county, New Jersey, November 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a weight or spring, supported by the back chain, when in action, with the brakes of a car, in the manner and for the purpose set forth."

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines. By M. V. Regnault.

SEVENTH MEMOIR.

On the Compressibility of Liquids, and particularly that of Mercury.

(Continued from page 264.)

In the experiments related in the preceding memoir, it was necessary to know the compressibility of mercury, for the purpose of applying the necessary corrections to the apparent results; but there is very great uncertainty as to the proper numerical value of this quan-

tity, and it appeared to M. Regnault, that the methods heretofore employed for the purpose of determining the compressibility of liquids, could be notably improved by making use of the apparatus which he had at his disposition.

The philosophers who have most successfully investigated this subject, are MM. Œrsted, Colladon and Sturm, and G. Aimé. The method employed by them consists, essentially, in placing the liquid to be examined in a kind of thermometer, with a reservoir of very great capacity, terminated by a capillary stem, open at top, and carrying divisions whose value is known in terms of the capacity of the reservoir. This apparatus, which has been called a *piezometer*, is placed in a glass vessel with very thick walls, which could be put in communication with an air pump, and with a compressed air manometer. (Pressure gauge.) This outer vessel being filled with water, the pressure which is brought upon its surface, is transmitted equally both to the inside and outside of the piezometer, and the liquid sinks in the graduated stem. This sinking shews, however, only the apparent compressibility of the liquid, and it will be equal to the absolute compressibility, only if the piezometer experiences no change of internal capacity, from the effects of the external and internal pressures. M. Œrsted contends that this change is insensible, and can arise only from the thinning of the walls. The mathematical calculation leads to very different results. Poisson (*Annales de Chimie et de Physique*, 2*me serie*, *tome* xxxviii, *p.* 330) has deduced from his investigations of elasticity, the formulæ which apply to the case of a spherical reservoir of known diameter and thickness. He has also shewn that, if we designate by a the elongation which a cylinder of any homogeneous material experiences, when one of its bases is fixed, and the other is drawn in the direction of its length, by a force P upon each unit of its surface, the cubical compression k which the same cylinder experiences, when its whole surface is submitted to the pressure P upon each unit of surface, is represented by the formula

$$k=\frac{3}{2}a.$$

Physical philosophers have generally adopted the deductions of the mathematical calculation, and assumed that the change of capacity which the piezometer experiences, is the same as that of a mass of glass having exactly the form of the enclosed liquid, under the same pressure; so that, to obtain the actual compressibility of the liquid, there must be added to the apparent compressibility the quantity $\frac{3}{2}a\ V$, V representing the interior capacity of the piezometer. M. Œrsted has endeavored to show the inaccuracy of the mathematical deductions, by determining, experimentally, the compressibility of water in two reservoirs formed by substances of very different extensibility, viz: glass and lead. The compressibilities appearing but little different in the two cases, M. Œrsted concludes that the correction given by mathematical analysis is not correct, and that this correction may be neglected when the walls of the piezometer have but little thickness.

MM. Colladon and Sturm assumed, in their calculations, that the coefficient of the cubic compressibility of the envelope, was equal to three times the coefficient of the linear elongation which is produced upon a rod of the same metal, by a traction equal, upon each unit of surface, to the pressure which is exerted upon the unit of surface of the piezometer. (*Ann. de Chim. et de Phys.*, 2*me serie, tom.* xxxvi, *pp.* 113 & 225.) M. G. Aimé (*Ann. de Chim. et de Phys.*, 3*me serie, tom.* viii, *p.* 257) employed a piezometer founded upon the same principles, but in place of producing the pressure by a forcing pump, he made use of the natural pressures which are obtained by lowering the apparatus in the sea. He thus obtained pressures much greater than those obtained by other experimenters. M. Aimé calculates the change of capacity of the piezometer, by the formula of M. Poisson.

It cannot be concealed that mathematical formulæ, like that which we are now considering, present great uncertainty, owing to the hypotheses which have to be adopted as to the molecular forces, in order to establish the differential equation of the problem. These hypotheses are probably very far from the truth. Thus mathematicians assume, that the molecules of a solid body move with equal ease in all directions, and that an equal displacement, no matter in what direction, always developes an equal reaction. This proposition is certainly incorrect, even in bodies of confused crystallization. It is very probable that a solid body experiences very unequal resistances in its displacements in different directions. We may, to a certain extent, consider these molecules as forming articulated systems, each system taking the motion easiest for it, when a pressure brought upon the external surface of the body, destroys the molecular equilibrium. It is, then, very desirable that direct experiment should be called in to decide as to the accuracy of the mathematical formulæ.

Besides, even supposing the formulæ irreproachable, there will still remain much uncertainty, on account of the manner in which the coefficient of compressibility (k) of the envelope is ordinarily determined. This coefficient is obtained by measuring the elongation which a glass rod of known length and cross-section undergoes, when it is submitted to a given traction. It is difficult to be certain that the glass rod used for the experiment, is of the same kind as the tube which forms the reservoir of the piezometer; and even if the two specimens of glass came from the same pot, we must still admit that the coefficient (k) is the same in the solid rod as in the tube with thin walls—that it is the same in the longitudinal as in the transverse direction: in a word, the glass must be supposed perfectly homogeneous in all directions, and not affected in an unequal way, by the working to which it has been submitted.

The experiments which have hitherto been made, by different physical philosophers, upon the elasticity of glass, have given very different numbers; which proves that this elasticity varies considerably with the nature of the glass. Designating by P the pressure upon a square millimetre, by a the elastic elongation by metre, expressed in millimetres, by q what has been called the *coefficient of elasticity*, we have, by the definition, $q = \frac{P}{a}$.

The following values have been found for q, for a when P is equal to one atmosphere, and for the cubic compressibility calculated by the formula $k=\frac{3}{2}a$.

		q	a ($P=0_k{\cdot}010298$)	k
	Colladon & Sturm,	10000	0 0000010298	0·0000015447
	Savart,	6009 to 6055	0·0000017137 0·0000017007	0·0000025705 0·0000025510
Wertheim & Chevandier.	Window glass from St Quirin,	7917	0·0000013008	0·0000019512
	Plate glass from Cirey,	7015	0·0000014680	0·0000022020
	Table glass from Valeristhal,	6890	0·0000014946	0·0000022419
	White flint glass from Baccarat,	5477	0·0000018822	0 0000028233

But it is easy to arrange the experiment so that it shall give, at the same time, both the compressibility of the liquid, and that of the envelope which encloses it.

The vessel, BCD, (plate V. fig. 1,) within which the pressure is to be exercised, is a copper cylinder, of 12 centimetres diameter, 40 centimetres height, and 2 millimetres thickness of wall. This vessel is closed by a cover of 1 centim. thick, fastened, by a red lead joint, to a collar soldered to the vessel. The cover carries three tubulures; into the central one ($c\,c'$) the graduated stem of the piezometer, A, is cemented, and the other two are closed by stop-cocks. Upon the stop-cock R is tightly fastened a lead tube ($e\,f\,g\,h$) leading to a large reservoir, in which air is compressed by means of a forcing pump. The lead tube ($g\,h$) is bifurcated at g; its second branch ($g\,k$) has a brass end inserted into the top of the stem of the piezometer, and carrying two stop-cocks, one of which (R''') opens or closes the communication with the piezometer, and the other (R'') opens into the atmospheric air. The vessel, BCD, is filled with water, and kept in another larger vessel, MN, also filled with water, which prevents the temperature of the piezometer from changing sensibly during the experiment. The following is the method of operating:—

First Period.—The reservoir being filled with air, under a pressure measured exactly by the open tube pressure-gauge, (described in the last memoir,) the stop-cocks R and R''' are shut, the stop-cocks R' and R'' opened; the piezometer is then submitted, both internally and externally, to the pressure of the atmosphere. The position of the extremity of the column in the graduated tube is noted—suppose it corresponds to m divisions.

Second Period.—The stop-cock R' is closed, and R opened; the pressure of the air reservoir is now exerted in the vessel BCD. The

piezometer then supports on its exterior, the pressure of the air in the reservoir, (P,) while its interior sustains only the pressure of the atmosphere (p). The capacity of the reservoir diminishes under the excess of external pressure, and the liquid rises to m' in the graduated tube. Thus $m'—m$ represents the decrease of cubic content of the piezometer, under the pressure $P—p$.

Third Period.—R' remaining closed and R open, R'' is closed and R''' opened. The piezometer now sustains the pressure P both on its outside and on its inside; the liquid column descends and stands at m'' in the graduated tubes;—$m—m''$ then represents the apparent contraction of the liquid.

Fourth Period.—R is closed, and R' opened; the pressure P is kept up in the interior of the piezometer, while its exterior bears only the pressure of the atmosphere; the liquid column descends to m''', and the effect produced is measured by $m—m'''$.

Fifth Period.—R''' being closed, and R'' opened, the piezometer is again subjected to the atmospheric pressure only, and if it has not sustained any permanent alteration of capacity, the contained liquid should rise again to m. This was found to be very generally the case, and when, owing to a slight change of temperature, it was not strictly so, the difference was so small, that the mean of the first and last observations was taken as the value of m.

By this method of operating we obtain three observations, which give three equations between the unknown quantities μ and k. We may then, by their means, determine both these quantities, and there remains an equation of condition, which may serve to test some of the consequences deduced from the mathematical formulæ.

The use of an atmosphere of compressed air to develope the pressure, presents great advantages over the compression by means of a forcing pump, because the pressures are then perfectly constant, and may be measured with great precision. By opening the stop-cocks slowly, the pressures are changed gradually, which is indispensable, for sudden variations of the pressure often produce permanent changes in the cubic content of the piezometer. At the request of M. Regnault, M. Lamé, who has paid much attention to the mathematical study of elasticity, deduced from the equations the following formulæ, applicable,

1st, To the case of a spherical reservoir,—

$$kP=\frac{1}{V}\frac{4\omega'}{9(N+1)},\quad \mu P=\frac{1}{V}\left(\omega''+\frac{4\omega'}{9(N+1)}\right),\qquad \omega''=\omega-\omega'.$$

2d, To the case of a hollow cylinder terminated by plane bases,—

$$kP=\frac{1}{U}\cdot\frac{3\lambda'}{8(M+1)},\quad \mu P=\frac{1}{U}\left(\lambda''+\frac{3\lambda'}{8(M+1)}\right),\qquad \lambda''=\lambda-\lambda'.$$

3d, To the case of a hollow cylinder with hemispherical ends,—

$$kP=\frac{\theta'}{\frac{8}{3}(M+1)U+\frac{9}{4}(N+1)V},$$

$$\mu P=\frac{\theta''}{U+V}\cdot+\frac{\theta'}{\frac{8}{3}(M+1)U+\frac{9}{4}(N+1)V},\qquad \theta''=\theta-\theta'.$$

In which equations,—

k represents the cubic compressibility of the solid matter of the reservoir, referred to the units of volume and of pressure.

P, The excess of the internal over the external pressure.

$V, = \frac{4}{3}\pi R^3$, the cubic content of the spherical portion of the reservoir, when under the atmospheric pressure internally and externally.

N, The ratio of V to the solid content of the spherical portion of the reservoir.

ω, The apparent diminution of the volume (V) of the liquid under the pressure P.

ω', The apparent increase in the bulk of the liquid, when the pressure P is exerted from without inwards.

ω'', The apparent diminution of the volume of the liquid, when the pressure P is exerted both externally and internally.

U, The cubic content of the cylindrical portion of the reservoir, when submitted to the atmospheric pressure, both inwardly and outwardly.

M, The ratio of U to the bulk of its solid envelope.

$\lambda, \lambda', \lambda''$, correspond in the cylinder, to ω, ω', and ω'' in the sphere.

$\theta, \theta', \theta''$, correspond in the cylinder with hemispherical ends, to ω, ω', and ω'' in the sphere.

μ, The cubic compressibility of the contained liquid, referred like k, to the unit of volume and pressure.

M. Regnault tried three series of experiments on the compressibility of water, in spherical piezometers of copper, and of brass, and in a cylindrical one of common glass.

The following are the results of these three series:—

Table of the Compressibility of Water.

	Extreme pressures in Atmospheres.	Apparent Compressibility.	Compressibilities calculated by Lamé's formulæ.	
			Water. μ	Reservoir. k
Spherical copper reservoir, Mean of 24 experiments,	From 2·8033 to 7·8220	0·000046392	0·000047709	0·000001317
Spherical brass reservoir, Mean of 46 experiments,	From 1·5542 to 9·1206	0·000046847	0·000048288	0·000001440
Cylindrical glass reservoir, Mean of 36 experiments.	From 2·5387 to 10·3528	0·000044304	0·000046677	0·000002368

In the first series, there was remarked a regular decrease of the coefficient of compressibility as the pressures increased; as, however, this did not shew itself in either of the other series, and as the coefficients of compressibility of the metal (k) were irregular, this apparent decrease was probably due to permanent changes of capacity in the reservoir, the metal of which is soft, and but slightly elastic.

The coefficient k, obtained in these experiments, is less than that deduced from the measurement of elongation by the formula,

$$k = \frac{3}{2} a.$$

The different values of the means for the apparent compressibility, varying more than can be attributed to errors of observation, show, in M. Regnault's opinion, that M. Œrsted was in error, in supposing that the change in the capacity of the piezometer, during the experiments, might be neglected; while the differences of value for the absolute compressibility, which, though smaller, are still without the limits of errors of observation, show, either that the formulæ do not exactly represent the phenomena, or that the experiments are far from realizing the conditions admitted in their establishment.

Experiments on the Compressibility of Mercury.

The determination of the compressibility of Mercury was the principal object of these researches. The piezometer employed was the glass one used in the experiments with water. The method of operating was exactly the same. The following table, which we copy entire, contains the results of these experiments.

Compressibility of Mercury in a Cylindrical Glass Piezometer.

Pressures.		Action.					Compressibilities Calculated by Lamé's Formula.	
In millimetres.	In Atmospheres.	External ω'	External and Internal. ω''	Internal. ω	$\omega'+\omega''$	Apparent Compressibility δ	Mercury. μ	Glass. k
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2535·98	3·3368	10·150	0·450	10·450	10·60	0·000001270	0·000003670	0·000002400
2534·36	3·3347	10·150	0·450	10·450	10·60	0·000001270	0·000003670	0·000002400
2533·72	3·3338	10·150	0·350	10·300	10·50	0·000000990	0·000003390	0·000002400
2531·82	3·3326	10·100	0·500	10·400	10·60	0·000001410	0·000003790	0·000002390
2530·22	3·3292	10·100	0·400	10·300	10·50	0·000001130	0·000003520	0·000002390
4262·62	5·6087	17·050	0·650	17·450	17·70	0·000001090	0·000003490	0·000002400
4255·65	5·5995	16·875	0·725	17·625	17·60	0·000001220	0·000003600	0·000002380
4251·55	5·5941	16·950	0·700	17·450	17·65	0·000001170	0·000003550	0·000002380
4225·48	5·5598	16·600	0·800	17·450	17·40	0·000001350	0·000003710	0·000002360
4217·67	5·5495	16·600	0·700	17·050	17·30	0·000001180	0·000003540	0·000002360
4209·66	5·5390	16·650	0·550	17·050	17·20	0·000000930	0·000003300	0·000002370
5394·29	7·0978	21·250	0·850	22·050	22·10	0·000001120	0·000003480	0·000002360
5381·92	7·0815	21·200	0·900	21·900	22·10	0·000001190	0·000003550	0·000002360
5372·61	7·0692	21·100	0·850	21·850	21·95	0·000001130	0·000003490	0·000002360
5361·94	7·0549	21·075	0·825	21·775	21·90	0·000001100	0·000003460	0·000002360
6756·05	8·8895	26·500	1·100	27·500	27·60	0·000001160	0·000003520	0·000002360
6741·24	8·8832	26·550	1·050	27·450	27·60	0·000001110	0·000003470	0·000002360
6715·90	8·8367	26·550	1·000	27·300	27·55	0·000001090	0·000003420	0·000002360
7300·25	9·6056	28·800	1·100	29·750	29·90	0·000001080	0·000003450	0·000002370
7281·80	9·5813	28·750	1·050	29·650	29·80	0·000001030	0·000003400	0·000002370
7266·78	9·5615	28·700	1·100	29·600	29·80	0·000001080	0·000003450	0·000002370
7251·05	9·5408	28·650	1·100	29·550	29·75	0·000001080	0·000003450	0·000002370
					Means,	0·000001234	0·000003517	0·000002374

The values of k, the compressibility of the glass envelope, are exactly the same as those found in the experiments upon water, which

is a proof of the accuracy of the observations. The apparent compressibility of mercury in glass is extremely small, which makes its accurate determination very difficult; so that we see that, in column 7, the variations are considerable, when compared with the absolute value of the quantity to be determined.

The absolute compressibility $\mu=0{\cdot}000003517$ necessarily presents a little uncertainty, arising from the correction which should be applied for the change of capacity of the envelope. The compressibility of mercury, under a pressure equal to the weight of a column of one metre of mercury, is $\mu'=0{\cdot}000004628$.

On the Heat Developed by the Compression of Water.

Numerous experiments, carefully conducted, shewed that the heat developed by a sudden pressure of 10 atmospheres upon water, was not able to raise its temperature $\frac{1}{50}$th of a degree centigrade. This quantity, therefore, wherever it occurs, may be neglected.

(To be Continued.)

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Explosion of the Steam Packet Concordia.

New Orleans, Sept. 23, 1848.

Gentlemen:—I send you sketches of the appearance of the boilers of the steam packet Concordia, taken the next day after their explosion, and before any change had taken place in their position among the ruins. The explosion of the boilers, (they were 30 feet long, 40 inches diameter, with two 15-inch flues,) took place about 5 o'clock, A. M., on the 17th of September, 33 miles above this city, at, or near, the town of Plaquemine. There are contradictory statements on this head, some accounts being that she was at the landing, and others, that she was half a mile off, racing. This I have not taken any pains to correct, preferring to come to my own conclusions, by a critical examination of the boilers, which tell the truth for themselves. *The cause was a deficiency of water.*

I will now enter into a description of the sketches, premising that the view was taken from the boiler deck of an adjoining steamboat, and gives the correct position of the boilers and fragments, excluding al that is not connected with the exploded boilers. The two starboard boilers are not much injured, being only displaced a little.

Fig. 1, is the larboard outside boiler, which was carried 16 feet astern of its bed, and lays on the main deck.

Fig. 2, is the next inside. The after end is nearly in its place, the boiler being partly on its side. The forward end has been thrown about 7 feet sideways, towards the guards.

The flue, *a*, is collapsed, except a very small portion of the after end; a piece of the forward end, a^1, being torn off. This piece of the flue is also separated from the parts of the head, fig. 4, and is of cylindrical form;—an indentation and crack is formed by its coming in contact

with something solid. At *b*, the flue is nearly asunder, (see the enlarged view, fig. 3.) This cracked part is very bad iron, much laminated, showing imperfect welds, and has a very rotten appearance,—the same may be said of the end torn from the after head. This flue has evidently been red hot, and the collapsing pressure was so great, that the internal heads of the rivets can all be counted outside, having indented the sheets, and each rivet forming a projection on the plane outer surface.

The flue *c*, in the same boiler, has its cylindrical form, and has not the appearance of having been much over-heated; a fragment of the cast iron front head is still on it. *d* shows part of the shell, it being nearly vertical. *e* is the other part of the shell, partly turned down. *f* is part of the steam drum, with a piece of the steam pipe attached. It stands nearly perpendicular, its head resting on the bent part of *e*.

Fig. 4, is part of the shell torn from the end of fig. 2. It is doubled up, and is nearly flat; one chock joint still hangs to it. *g g g* shows fragments of the cast iron head still attached to the sheets.

Fig. 5, is part of the shell that has been stripped off of fig. 1, at *h*. It presents nearly a plane surface, and its nearest edge to the end of the boiler, fig. 1, is 10 feet, measured diagonally on the main deck.—This presents the most remarkable feature of this explosion. I have seen the remains of many exploded boilers, but never any thing similar to this. The flues are perfectly good, and the remaining part of the shell is as it was before, except some slight indentations caused by the unequal surface it fell on.

A very small portion of the fractures of the shell follow the line of the rivets, the tears being through the solid parts of the sheets. With the exception of the flue *a*, the iron is of good quality, the clean fractures presenting the appearance of tough iron, and it is of the usual thickness. The boilers are said to be five years old; if so, they have no indications of that age.

The water-line in each boiler is well defined. Commencing with the starboard one, it is one inch above the level of the flues; the next one to it is two inches above the flues; the next being the boiler fig. 2, the highest water-line is quite one inch *below* the tops of the flues, and in the outside boiler, fig. 1, it is about half an inch below the flue tops.

There must have been some obstruction in the standing pipes, through which the water is forced into each boiler, to account for the unequal height of the water-lines; or it is possible that, from some cause, more heat was applied to these two boilers, thereby generating a greater quantity of steam, which, not escaping freely into the other boilers, the excess of pressure on the surface of the water, forced it into that which had the highest water line.*

The collapsing of the flue *a*, I believe to be the origin of the explosion—the part at the head of fig. 2, and the gap at the after end, occur-

* I once had charge of three cylinder boilers, (the fuel being coal,) in which there was a regular ebb and flow. Sometimes all the water would be in one outside boiler, and then it would pass to the other outside one. The rise of the surface of the water, in either of the boilers, could be made at pleasure, simply by opening the fire-door under that boiler.

ing at the same instant of time, the outside boiler following. The breeches and lower part of the larboard chimney, being carried away so suddenly that the upper part of the chimney descended perpendicularly, and the starboard chimney falling over it, presents the appearance, (looking from the bow,) as shown by fig. 6.

The force of the explosion was upwards, carrying away part of the boiler deck, and also the hurricane deck, or roof, just forward of the pilot's house—the breach measuring about 28 feet fore and aft, and being clear across the boat.

The doctor,* which is immediately behind the boilers, is very little injured.

Six persons were killed outright, and six or eight, including the captain and engineer, were badly scalded; two of these have since died.

Many engineers on this river (and this is a marked instance) are in the habit of carrying low water, under the erroneous impression that more steam can be generated by so doing—which I know to be false, for I have made many experiments to test that matter, during the last sixteen years, and invariably found that more power could be obtained from high water—and this leads to explosions if the least derangement takes place to prevent the supply; or, what is worse, throwing a large body of water, of low temperature, into the overheated boiler.

It is said that a committee of engineers are to be appointed, to examine into the causes of this explosion. If any additional information is produced by their report, I will forward it to you, so that it may be incorporated with this.

Respectfully yours, A. C. Jones.

New Orleans, October 2, 1848.

Enclosed is the report of the Committee of Engineers, inquiring into the causes of the explosion on board the steamer Concordia, a description and sketch of which I forwarded to you under cover. This report throws no additional light on the subject, but confirms my opinion of the cause,—my examination having been prior to theirs.

I have seen a counter report, drawn up by friends of the engineer, which, in my opinion, is calculated to do him more harm than good. Their examination took place some time after the others, and, of course, the appearance of things was changed. I will state that I have no connexion with either party, having made my examination, on the arrival of the boat, on my own hook.

Respectfully, A. C. Jones.

Meeting of Engineers on board Steamboat Concordia.

In accordance with the request of Captains Pease and Thomasson, a number of practical and scientific engineers, (being about twenty-

* As Northern readers may not understand this term, I will state that it is the name of the supplemental engine, used for pumping water into the boilers—pumping the water out of the hold—and acting as a fire engine in time of need.

three,) convened on board said boat, lying opposite New Orleans, to examine the causes that led to the late disaster on board said boat.

After a thorough examination of the exploded boilers, the meeting was called to order, by the selection of Mr. Daniel Blair as President, and H. C. Vontagen and John F. Hunt, as Secretaries. Whereupon, the following committee was selected to report upon the causes of the disaster:—Edward Grinnell, Daniel Blair, James Armstrong, John F. Hunt, Mr. Longmaker, H. Conduit, Mr. Lupton, Mr. McFarland, Mr. Douglass, H. C. Vontagen, and Mr. Murrey.

After mature deliberation, and hearing evidence, adduced before the committee, they reported as follows, which was unanimously adopted.

Daniel Blair, *President.*

H. C. Vontagen, } *Secretaries.*
Jno. F. Hunt, }

Report of the Committee.

Whereas, the steamboat Concordia, Capt. Horace Pease, left New Orleans on Saturday evening, the 16th instant, on her customary trip for Millikin's Bend, and having proceeded without accident, till about half a mile above Plaquemine, about half-past four o'clock, A. M., on the morning of the 17th, the aforesaid boat did explode her two larboard boilers, whereby several of the officers and crew were killed, and others scalded; and whereas, at the instigation of Captains Pease and Thomasson, the undersigned have visited the said steamboat Concordia, for the purpose of investigating the causes of the explosion, and report as follows:—

That, from the appearance of the boilers, there was, at the time of the explosion, a deficiency of water,—though, from evidence adduced, it appears that the second engineer left watch some half hour previous to the accident, and left with an adequate supply of water in the boilers.

That it may be possible that the flues in the larboard boiler were bare of water, in consequence of the boat having been listed to starboard considerably, when leaving Plaquemine, and, when righting up, the water came in contact with the flues, intensely heated by thus being left bare.

And further, that this meeting has seen ample certificates as to the character of the first engineer, who had the misfortune to be on watch at the time of the explosion, and that said certificates are fully sufficient to exempt Captain Pease and owners from all blame in employing him.

Edward Grinnell, *Chairman.*

H. C. Vontagen, *Secretary.*

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Leaden Shot and Fowling Pieces.

Of the origin of small leaden, or dropped-shot—perhaps the simplest, and certainly the most purely philosophical, of manufactures—little or

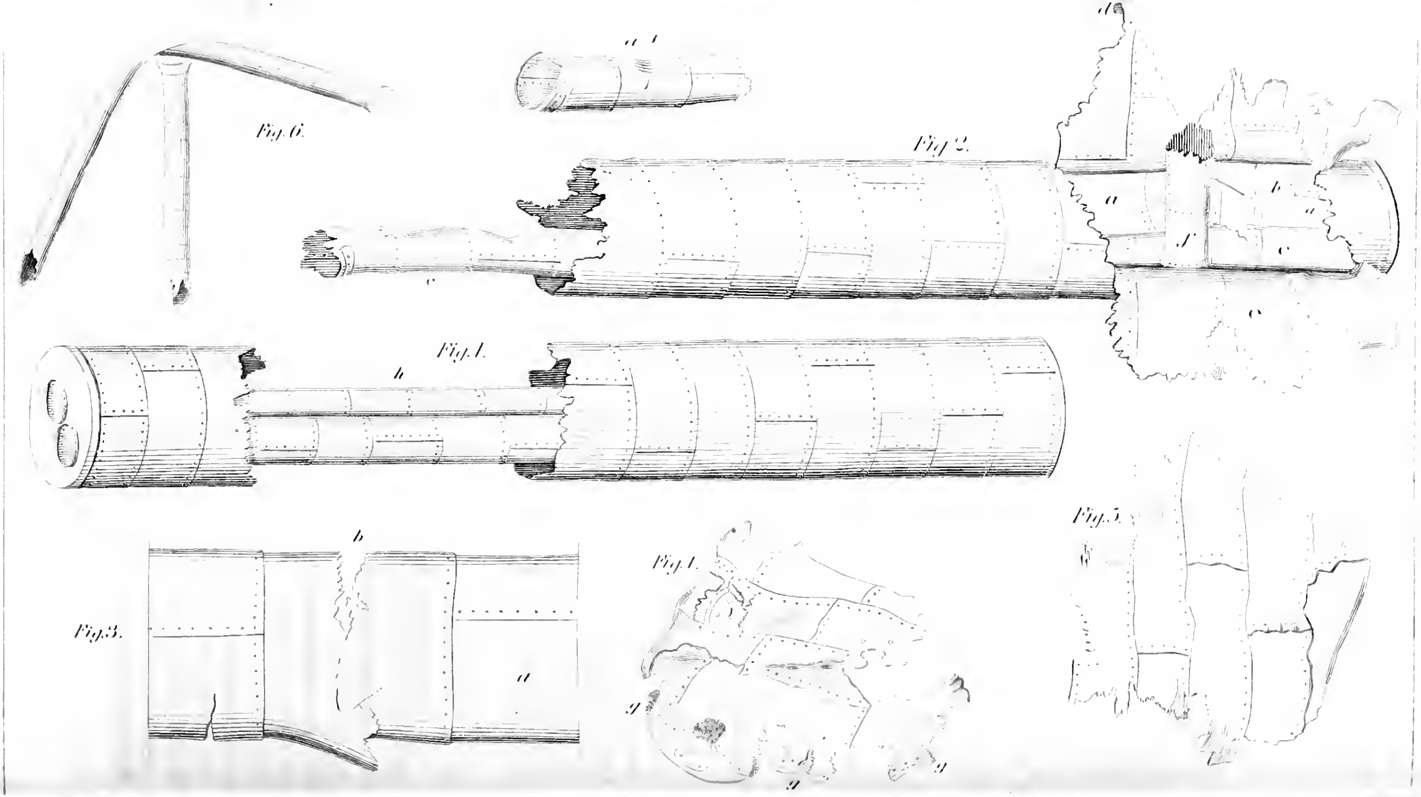


Fig. 6.
Fig. 2.
Fig. 1.
Fig. 3.
Fig. 4.
Fig. 5.

nothing is known. This is to be regretted, for a knowledge of the thoughts and circumstances that led to, and attended, its developement, would have been exceedingly interesting.

In other departments of metallurgy, workmen toil, with many tools, to mould, cast, turn, hammer, and file substances into desired forms; but the modern shot-maker, as if soaring in science above his neighbors, as well as operating over their heads, mounts a tower, and listlessly pours his metal into free space, confident that, as it falls, Nature will break and mould it into the form he wants, while he stands looking on. Nor is he disappointed. By the same law that spherules of dew, of hail, and rain, are shaped, shot is made—the law by which the materials of the sun and moon, the globe we inhabit, and all the mightest and minutest orbs, whirling through the heavens, were gathered round their common centres. Of creation's paramount influence, and its operations in space, what more beautiful illustration! The artist imitates his Maker, for of what is the universe composed, but of variously sized shot, dropped from the hands of the Deity?

The facility with which streams of metal are changed, in this way, into spheres, the accuracy of outline, and beauty of finish attainable, are remarkable. But for immediate oxidation, the surface of the globules would be smooth and bright, as those of water or quicksilver. Whether the invention came in with the match-lock from the East, or is a European one, has not, that I am aware of, been ascertained.—Some persons have supposed that Watts, of Bristol, who patented a process for making it in 1782, was the first maker;—a great mistake. His mode differed in nothing from the ancient one, except in dropping the fused metal from greater elevations than had been the previous practice. "For small shot," he says, "*ten* feet, and for the largest, 150 feet, or more." *See Rep. Arts*, III, 1795.

That this missile was an early accompaniment of portable fire-arms is pretty evident; but the date of its appearance, and the name of its author, are under a cloud.

That primitive muskets were devised to kill men, and, for a while, confined to that purpose, is probable, but their application for destroying smaller game was too obvious to be overlooked. Beckman says they were too long and heavy to be fired without a prop, and were *first* used in war at the siege of Parma, in 1521. Not so. Edward IV had 300 Flemings in his service, armed with them, in 1471. They formed part of the armament of Columbus; and further, soldiers are repeatedly figured in the act of firing hand-guns, without rests, and with trigger-locks, taking sight, and handling them like modern troops, in the German translation of Vegetius. *(Enffurt*, 1511.) They appear there as common as artillery, of which greater varities are portrayed than are now in use.

There is a passage in Petrarch's "*Phisicke against Fortune*,"—("Englyshed by Thomas Twynne," Lond. 1579,) which implies that, in his day, they were common. He died in 1374. It occurs in the 48th dialogue, when "Reason," remarking on personal arms, says:—

"A father can leave none other inheritance to his sonne than he hath, to wyt: his bowe and arrowes, his *piece*, his shielde, his swoorde

and wane, and that also which maketh up the game, his golden spurres."

Now *piece* was the old technical name for portable guns; hence, as their varieties increased, arose "Wall Pieces," "Birding Pieces," "Fowling Pieces."

The 99th Dialogue is "On Engines and Artillerie." One passage, though not relating to the special object of this paper, is worth extracting.

"*Joy.*—I have innumerable engines and artillerie.

"*Reason.*—It is marueyle, but thou hast also pellets of brasse, which are throwne foorth with terrible noyse of fire. Thou miserable man, was it not yenough to heare the thunder of the Immortal God from heaven? O, crueltie joyned with pryde. From the earth, also, was sent forth unimitable lightning, with thunder, as Virgil sayth, which the madness of men hath counterfeited to do the like: and that which was woont to be throwne out of the cloudes, is now throwne abrode with a *wooden* [?] instrument, but of a deuylish deuice, which, as some suppose, was inuented by Archimedes, at what tyme Marcellus beseiged Syracuse. Howbeit, he devised it to the extent to defend the libertie of his citizens, and to auoyde or defende the destruction of his country, which you now use to the subiection or subuertion of free people. *This plague of late dayes was but rare,* insomuch as it was behelde with great woonder, but now, as your myndes are apt to learne the worst thyngs, so *it is as common as any other kind of munition.*"

This extract removes all doubt respecting the "*Crakys of War,*" alleged to have been employed in 1327, by Edward III, in Scotland, and subsequently at Cresci. Chaucer speaks familiarly, too, of gonnes.

Hand-guns, apparently with match-locks, were in use by English gentlemen and yeomen, under Henry VII, and must have been rather extensively used in fowling, and killing small animals; since a stringent game law, passed in the sixth year of Henry VIII, repeals "former statutes touching shooting with cross-bows and hand-guns," and enacts that whoever keeps in his house, or shoots with, a hand-gun, shall forfeit it, and pay "ten pounds for every shoot," unless he have a yearly income of three hundred marks.

In the 33d year of Henry VIII, fresh regulations were made respecting "hand-guns, hagbuts, or demy-hakes." The former were to be a yard long, the latter three-quarters. The preamble states that people went about with "little short guns, and little hagbuts, furnished with gunpowder, fire, and touch." All persons were prohibited to kill fowl and deer with them, except such persons as were worth, in land, a hundred pounds yearly. One section applies to the *makers* of them. From the expression "fire and touch," it would seem that the flint lock was not then known, or but little known, to British sportsmen.—(See Keble's Statutes at Large, Lond. 1681.)

Up to this time, (1542,) there is no intimation of dropped-shot, and we are left to conjecture what the missiles were which fowlers used. "Half-shot" were in vogue, and they, I suppose, were small bullets or buck-shot. It appears, however, that dropped-shot was known to-

wards the end of the reign of Henry VIII, since it is expressly mentioned, and by its old characteristic name, in a law passed in the second year of Edward VI.

"Whereas, an act was made in the 33d year of the late King of famous memory, Henry the 8th, for some liberty to shoot in hand-guns, haques, and harquebuts; by which act it was provided that no person should shoot in any of the above said pieces, but at a bank of earth, and not at any deer or fowl, unless the party might dispend an hundred pound by the year. Forasmuch as the said act having been devised, as it was then thought, for necessary exercise, tending to the defense of the realm, is grown sithen to the maintenance of much idleness, and to such a liberty, as not only dwelling houses, dove-cotes, and churches, are daily damaged by the abuse thereof, by men of light conversation, *but that also there is grown a customable manner of shooting of* HAIL-SHOT, whereby an infinite sort of fowl is killed, and much game thereby destroyed, to the benefit of no man; whereby, also, the meaning of the said statute is defrauded, for that the said use of *hail-shot* utterly destroyeth the certainty of shooting, which, in wars, is much requisite. Be it therefore enacted, that no person, under the degree of a Lord in Parliament, shall, from henceforth, shoot in any hand gun, within any city or town, at any fowl, or other mark, upon any church, house, or dove-cote. Neither shall any person shoot in any place, *any hail-shot*, or any more pellots than one at one time, upon pain," &c.—that is, a fine of ten pounds for every shot, and three months' imprisonment.

A second section declares the above is not to prejudice the rights of those allowed to shoot by the 33d of Henry VIII—the use of "*hail-shot* excepted, as, indeed, *that kind of shot* in the said act was not meant."—*(Statutes at Large.)*

From the last remark, the inference is, that this shot was introduced into England—if not invented there—between 1542 and 1548.

The objection, that the substitution of a number of shot for a single one, would diminish the previous accuracy of aim, was well taken. It is doubtful whether modern sportsmen equal—they certainly do not surpass—their predecessors in this respect. Shooting game flying, with the bow, was quite common; but the perfection of fowling was to hit a bird on the *bill* so as not to lacerate the body. This was beating the old marksman, who addressed an arrow to Philip's right eye.

In the first of James I, cap. 27—another severe game law—hail-shot is forbidden to be fired from "hand-guns or birding pieces," except by persons duly licensed, and then only to kill "crows, pyes, rooks, ring-doves, jays," &c., "for hawk's-meat only." Here, again, the old hand-gun is a regular fowling piece. When Falstaff proposed to hide himself in the chimney, Mrs. Ford told him that would not do, as "there they always use to discharge their birding pieces." The same hero describes his recruits as starting at the report of a caliver—a sportsman's gun—"worse than a struck fowl, or a hurt wild-duck."

The oldest direction for making hail-shot that has fallen in my way,

dates no further back than the middle of the 17th century. It is professedly copied from previous writings. The essential parts run thus:

"Melt lead down in an iron kettle, skim it, and when 'tis so hot that it begins to turn greenish, strew as much fine powdered auripigmentum (arsenic) upon it as will lie upon a shilling, to every twelve or fifteen pound of lead, which then must be stirred well, and the auripigmentum will flame. A little may be taken out in a ladle for an essay, and which, when reduced to a proper heat, may be dropt into a glass of water. If the drops prove round, and without tails, there is auripigmentum enough therein, and the temper of the heat is as it should be; but if otherwise, more auripigmentum must be added, and the heat augmented till it be found right."

Directions then follow, to pour the metal through a perforated dish in the usual way, and to sort the shot by means of sieves.

The most remarkable part of the direction is the short space the metal fell through. The perforated dish was "placed on two bars, or other iron frame, over a tub of water, about *four inches* from the water." No wonder "the greatest care was to keep the lead at so moderate a heat, that it be not too cool, to stop the holes, nor too hot, which will make the drops crack and fly;—for the cooler it is, the larger the shot will be. Such as will have very large shot, make the lead trickle with a stick, out of the ladle into the water, without a [perforated] plate."

It would be difficult to point out, in the records of the arts, an example of dullness in old workmen, so gross as the history of hail-shot exposes. For about 240 years previous to Watts' improvement, its fabricators dropped it close to the vessel of water prepared to receive it, while every ounce they made, was attended with embarrassments that loudly suggested a greater fall. Had they melted the metal on a second floor, and poured it from the window, an amount of trouble and mortification would have been avoided, which no one, not practically acquainted with its manufacture, can appreciate. I know not how to account for the fact, unless by supposing no manufactory of any consequence was established, to supply the public, and that sportsmen were in the habit of making it for themselves.

That buck or cast shot sometimes went by the name of hail-shot appears evident. In 1594, some English sea rovers, under James Lancaster, took Pernambuco. The writer of the expedition, in Hakluyt, says their muskets were provided with "haile-shot, which severely gauled the Indians and Portuguese." That this was not dropped shot, appears from his next sentence. "And this is to be noted, that there was both the horse and his rider slaine with one of these shot."

E.

Translated for the Journal of the Franklin Institute.

New Metallurgic Treatment of the Ores of Copper. By MM. Rivot *and* Phillips.

This process, by means of which the authors have already treated more than 600 lbs. of copper ore, is principally applied to the sulphur-

etted ores. The ore is first roasted, to reduce it, in great part, to the oxide of copper; then melted with silicious materials, to transform it into a silicate; and it is from the melted silicate that the copper is precipitated, by placing in it bars of iron.

When the reverberatory furnace, in which the authors operate, is very hot, they charge it with a mixture of the roasted ore, with lime or sand, and the slag from a former operation, in sufficient quantity to cause the fusion of the mass; they add charcoal, or poor bituminous coal of small size, in proportion to the quantity of the ore treated.—After the charge, one or two shovels-full of small coal is thrown upon the surface, to preserve it from oxidation from the furnace flame. It is also stirred from time to time, so as to permit it to be heated more uniformly, and melted quicker. The authors have succeeded in melting it completely, in four hours. As soon as the matter begins to thicken, the parts which adhere to the stirrer contain a certain quantity of grains of copper. When the fusion is complete, the tools plunged into the bath, shew that the copper is collected at the lower part of the hearth, near the discharge hole.

When the whole is perfectly fused, six bars of iron, weighing together from 70 to 90 pounds, are placed in it, the ends slipping in grooves opposite to the working door, taking care to plunge them entirely in the bath. Some fresh small coal is thrown upon the surface of the cinder, to prevent the peroxidation of the protoxide of iron of the cinder by the flames; then every two hours it is stirred with two-pronged rakes. A powerful method of stirring also consists in the use of a wooden pole, which, plunged into the cinder, gives a considerable disengagement of gas, and produces strong ebullition.

The authors have found, that, in three or four hours, the action of the bars will reduce the content of the cinder to 0·004 to 0·006. After that time the bars are withdrawn, and the metal drawn off.

The entire duration of an operation is, therefore, eight hours, and three operations per day may easily be made.

The loss of weight by the bars, varied, in the experiments of the authors, from 2 to 12 lbs., for quantities of copper from 24 to 44 lbs., obtained from ores of different richness.—*Bull. Soc. Enc. Indus. Nat., May,* 1847, *p.* 248.

Death of Berzelius.

We last week recorded the death of the celebrated Swedish chemist, Berzelius, in the 69th year of his age. He had been for a long time in declining health,—and, although his death will not have taken Europe by surprise, there will be but one feeling of grief for so great a loss. In a century which has produced a greater number of distinguished chemists than, perhaps, of any other class of men of science, Berzelius stood out as a star of the first magnitude. If, perhaps, our younger students of chemistry have, in some measure, lost sight of him, amidst the brilliant researches of modern organic chemists, it must not be forgotten that the patient labors, and sagacious investigations,

of Berzelius, have done more to lay the foundations of organic chemistry, than those of any other chemist. To him, more than to any other man, belongs the honor of applying the great principles which had been established by Dalton, Davy, Wollaston, Gay-Lussac, and himself, in inorganic chemistry, to unfolding the laws which regulate the combinations forming the structures of the animal and vegetable kingdoms.

It is to the honor of Sweden, that Berzelius is only one of a number of her sons, whom the cultivation of natural science has led from poverty and obscurity, to the highest dignities and emoluments bestowed by the State. Of humble parentage, and beginning life with limited resources, the successful cultivation of chemistry procured for him, not only the respect and admiration of the world, but that position and consideration in his own country, which the man of science has a right to claim, and which it is the privilege of sovereigns and states to bestow.

Berzelius was born in the village of Väfversunda, in the canonry of Linkogring, in Ostgothland, on the 29th of August, 1779,—not at Linkagring, on the 20th of August, as is often erroneously stated in the many notices of him. His father kept the parish school in the village where young Berzelius was born, and there he appears to have received his early education. At the age of seventeen, he commenced his studies at the University of Upsala, hoping to qualify himself for the medical profession. At this time, although Sweden could boast of having produced a Bergmann, and a Scheele, the more brilliant genius of Linnæus had given to natural history such an impetus, that chemistry was scarcely regarded by the medical student. It is true that Afzelius, who was a nephew of Bergmann, and then filled the Chemical Chair at Upsala, had performed some very creditable chemical analyses; but his health was bad, and he was assisted by Ekeberg, who, though a skilful analyst, yet wanted the energy and other qualifications for a successful teacher. The lectures on chemistry were read, and no experiments were performed. These unpromising circumstances were scarcely likely to produce a great chemist, but they seem to have developed the genius of Berzelius. Prof. Johnston gives Berzelius's own account of the influences of his situation. The students were allowed to work in the laboratory once a week.

"Berzelius, like the rest, went to the laboratory soon after he had commenced his chemical course, and asked for an operation. The first that was given him, was to form colcothen of vitriol, (crocus mentis,) by heating sulphate of iron in a crucible. 'Well,' says he, 'every servant can do this. If this be all I am to learn, I may as well stay away.'—'Oh, but,' replied Afzelius, 'your next operation will be more difficult.' Accordingly, when he asked for a second operation, he was instructed to prepare caustic potash, by burning cream of tartar in a crucible. 'This so disgusted me,' says Berzelius, 'that I vowed I would never ask for another operation. Still I frequented the laboratory; and, at the end of three weeks, found myself attending regularly every day, though I had no right to do so, and Afzelius could have turned me out, yet I was allowed to return, and operate, and break

much glass,—while Ekeberg, especially, was much annoyed that I never asked a single question.—For,' he adds, 'I liked better to seek for information from reading, and thinking, and experimenting, than from men who, having little experience themselves, gave me, if not evasive, at least unsatisfactory, answers, regarding phenomena they had never themselves observed.' "

In the year 1798, Berzelius passed his philosophical examination, as preparatory to the final one for M. D. At this time he left the University; and in 1799 we find him assistant to a Dr. Hedin, a superintendent physician of the mineral waters of Medevi. The composition of these waters attracted the attention of Berzelius, and his first published essay was a dissertation, in conjunction with Ekeberg, on the mineral waters of Medevi. He underwent the examination for a licence to practice medicine, in 1801, and graduated at Upsal on the 24th of May, 1804. On leaving Upsal, Berzelius repaired to Stockholm, where he became assistant to Andrew Spaurnau, who sailed with Cook, in one of his voyages round the world, and was then professor there of medicine, botany, and chemical pharmacy.—Spaurnau died in 1806,—and Berzelius, by his inaugural dissertation on galvanism, and other papers, had already obtained for himself a sufficient degree of confidence to be appointed his successor. Although this chair embraced a very wide range of subjects, as was frequently the case with Swedish chairs at that time, Berzelius more especially devoted himself to chemistry. It does not appear, indeed, that he gave any lectures on botany, except at the Military College of Carlberg, where he also held an appointment as lecturer. At first he was not more successful in teaching chemistry than his predecessors; but having received a hint from Dr. Marcet, of London, that chemical lectures should be illustrated by experiments, he adopted this plan, and likewise abandoned the old practice of reading lectures. He used to express himself very strongly on the inutility of merely reading lectures. Although he first adopted Dr. Marcet's experiments in his class-room, he soon so far improved upon these, that his own became a model for the chemical class-rooms of Europe.

During the early period of his residence at Stockholm, he practised the profession of medicine, and, in 1807, was mainly instrumental in forming the Medical Society of that capital. In 1810 he was made President of the Royal Academy of Sciences at Stockholm; and, in the same year, received the appointment of Assessor of the Medical College, and was made a member of the Royal Sanitary Board. At this time, though scarcely more than thirty years of age, he had obtained great reputation as a chemist. He had published a work on animal chemistry, containing many original investigations on the fluids of the animal body; and which was subsequently translated—as, indeed, have been most of his works—into almost every language of Europe. In conjunction with Hisinger, he commenced, in 1806, the publication of a periodical work entitled "Afhandlingar i Fysik, Keim, och Mineralogi," which contained a series of papers by himself, constituting some of the most valuable contributions that had yet been made to analytical chemistry. His labors were regarded as of so much impor-

tance by the Royal Academy of Stockholm, that that body decreed him, in 1811, 200 dollars yearly for his chemical researches. In 1812, Berzelius visited England, where he was most cordially received. In that year he communicated, through Dr. Marcet, a valuable paper to the Medico-Chirurgical Society of London, "On the Composition of the Animal Fluids." In 1818 he visited France and Germany—countries in which he was better known than in Great Britain, as most of his papers and works were published in the languages of those countries, as well as in that of Sweden. In the same year he was appointed Secretary to the Academy of Sciences—a post which he held till his death. In 1831, he was allowed to retire from the active duties of his professorship at the Caroline Institute, but he still held the title of honorary professor. Up to this time he had resided in apartments provided for him, at the building occupied by the Academy of Sciences, —where, on the same floor, he had his study and laboratory, so that he could, with little difficulty, pass from his desk to his crucible, and husband his time to the greatest possible extent. He now, however, moved to a house of his own,—and in 1835 married the daughter of the town-councillor (staats-rathe) Poppius. In 1837 he received the Great Gold Medal of the Royal Academy of Stockholm,—and in 1840 the Diet of Sweden voted him a pension of 2000 dollars per annum. The scientific societies of Europe and America contended for the honor of inrolling his name amongst their members,—and with eighty-eight of these bodies it was connected. Nor was his sovereign, Charles John, behindhand in recognizing the most distinguished of his adopted countrymen. In 1815 Berzelius was made a Knight, and in 1821 a Knight Commander, of the Order of Vasa. In 1829 he received the Grand Cross, and in 1835 was made a Baron. The intelligence of this honor was conveyed to Berzelius by the hand of the King; who wrote himself a letter, intimating his deep sense of the merits of the philosopher, and expressing a hope that, in this nomination, the world would recognise a homage paid to the man who had consecrated his life to those useful researches which had been already recognized by Europe, and which it was the glory of Sweden to be able to appropriate, as the patrimony of one of her children. This letter was sent to Berzelius on his wedding-day. How few men of science have married, with a patent of nobility on the breakfast table! Sweden had, however, yet one more ovation for her beloved son. In 1843 he had been a quarter of a century Secretary to the Academy, and on this occasion a festival was given in his honor. The Crown Prince was in the chair,—and a portrait of the chemist, painted by Lieut. Col. Lodemark, was presented to the Academy.

Such was the calm, unruffled, successful career of the deceased philosopher. Would that the career of every disciple of science were as happy! He who was thus honored, merited it—merited it on account of his unwearied industry, his clear and manly intellect, his noble and amiable disposition. The diligence with which he worked, both in his study, and his laboratory, may be judged of by his systematic works, and original contributions to science. In addition to the works already mentioned, he published a "Manual of Chemistry," which

went through several editions, that of 1841 consisting of 10 volumes, —and, we believe, another larger edition has since been published. In 1822 he commenced the publication of an Annual Report on the Progress of the Physical Sciences, which has been published every year to the present time. These volumes are the most valuable record of chemical research extant, and contain a full report of the discoveries that have made the period to which they relate so remarkable in the history of chemistry. From 1806 to 1818, he published, with Hisinger, the periodical to which we have before alluded; and in these volumes we find forty-seven papers by Berzelius, all giving an account of original researches by himself. In addition to these, he has published works on galvanism, on analytical chemistry, on mineralogy, and a vast number of papers in various Transactions.

The name of Berzelius has been too intimately connected with the history of chemistry, for the last forty years, for us, in this slight sketch, to give an adequate idea of the influence which his discoveries and generalizations have exerted upon the science. To him it is indebted for the discovery of several new elementary bodies,—more especially selenium, morium, and cerium. He first demonstrated the acid nature of silica, and was thus enabled to throw light on the composition of a series of interesting mineral compounds of silica with the metallic oxides. This subsequently led to a whole re-arrangement of mineral bodies, and contributed greatly to the advance of mineralogy. His discovery of selenium led him to investigate its various compounds, and compare them with the sulphurets. These investigations again resulted in his generalizations on the nature of the sulphur salts, and a new classification of the various salts. Subsequently, he investigated the compounds of fluorine, and arrived at some of the most important and valuable results that have yet been obtained by the analytical chemist.

Whilst Berzelius was writing the first edition of his "Manual of Chemistry," Dalton had promulgated his idea of the atomic constitution of matter, and Davy had made his great discovery of the metallic bases of the alkalies. These directed his attention to the laws of combination. He was led to institute researches, with the most scrupulous care, into the combining proportions of the various elements, giving to each its correct number, and was enabled to obtain results perfectly harmonious with theoretical calculations made on Dalton's laws. He was enabled to extend Dalton's law, that one atom of one body unites with one, two, or three, &c., atoms of another body, and showed that two atoms would unite with three, and with five. He also pointed out the great fact, that two compounds which contain the same electro-negative body, always combine in such proportions, that the electro-negative element of one is a multiple by a whole number of the same element of the other. He not only gave to elementary bodies their combining numbers, but introduced the system of symbols, by which chemical labor has been so greatly facilitated. Till the time of Berzelius, organic chemistry was a waste, with here and there an attempt to explain the phenomena of living beings upon chemical principles,—

and which, from the entire want of experimental foundation, was even worse than useless. The compounds found in plants and animals, were not supposed to come within the category to which the laws of combination applied. Berzelius was the first to show that these laws could be applied to animal and vegetable products; and, in so doing, he opened the way for the discoveries of Mulder, Liebig, Dumas, Boussingault and others.

As a skilful manipulator, Berzelius has had few equals in the history of chemistry. To this we are indebted for the immense variety, number, and success of his analyses. Many of the analytical processes in use at the present time, have had their origin with him.

The personal appearance of Berzelius was that of a strong, healthy man, with nothing in his habits or manners to impress a stranger with a sense of his powers. A chemist who visited him says, "He has nothing of pretence, reserve, or singularity about him; so that his plainness drew from a fellow-traveler of mine, whom he allowed me to introduce to him, the observation, 'I would never have thought him the great man he is said to be.'" His attention to strangers was very great,—especially to those who took an interest in chemistry. With these he would frequently spend hours in his laboratory, explaining his methods of working,—and, on their departure, he left the impression that he was the honored party. He was an early riser, and gave the first part of the day to his most important work, whatever that might be. He seldom either wrote or experimented in the evening, leaving that part of the day for reading and social relaxation. He had no particular times for writing or experimenting; when he had a work to finish, he would write sometimes for months, without performing an experiment,—but if anything of importance occurred to him, during his writing, requiring further investigation, he would at once give up the pen, and work perhaps for weeks in his laboratory. Few men were more beloved in the city of Stockholm than Berzelius.

Were the merits of this great chemist less, we might not be able to afford to hint at any defects. But regarding him at a distance, he appears to us to have carried his caution beyond the requirements of scientific research. His feelings were conservative, and though constantly going forward to the new, he still clung with tenacity to the old. He was almost the last chemist of eminence that admitted Davy's theory of the elementary nature of chlorine. Even after envy and prejudice had given up their opposition, the caution of Berzelius withheld assent. In the recent advances of organic chemistry, also, and more especially in its applications to the physiology of plants and animals, Berzelius has looked on with the eye of a critic, and withheld, to the last, his adhesion to some of the advanced positions of this department of the science. We will allude to his criticisms on his brother chemists, which were sometimes unnecessarily severe, only to add that, in the latter years of his life, he has been heard to say, that he regretted having expressed himself in a way that could have given unnecessary pain to others. Lond. Athenæum, Aug. 1848.

TRANSACTIONS OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Report on Atmospheric Waves. By Mr. Birt.

The report consists of three parts:—the first having reference to the information we at present possess, relative to such individual waves as have been determined: the second treating of the barometric curves which result from the crossing of the north-westerly and south-westerly waves, the two principal systems common to Europe—the most prominent subject being that particular curve known as the "great symmetrical wave of November:" and the third embodying the results that have been obtained during the last year, illustrative of the symmetry of the "great wave," more particularly the locality of greatest symmetry, and the departure from symmetry in certain directions.

Under the second head, the author has thrown together the result of his inquiries into the *forms* presented by the barometric curves at certain stations, and has devoted attention to the symmetrical curve of November, as it has been observed at the Observatory at Greenwich, in the years 1841 to 1845. In connexion with this subject, the author remarked, "it has been assumed that the symmetrical wave of November consists of *five* subordinate waves, giving rise to the five maxima which characterize it, the central maximum forming the apex of the symmetrical curve, the remainder being subordinate thereto. (Association Reports, 1846, p. 125.)

"Upon a close inspection of the curves of the 'great wave,' as laid down from the Greenwich observations, six subordinate maxima can be traced, three on each side the central apex, which, in all the years, is by far the most prominent. The mean curve leads to the conclusion, that *Greenwich is not the point of greatest symmetry*, its closing portion being depressed more than two inches below the commencement. The next feature is the decided rise of the mercurial column, during a period of sixty-eight hours preceding the transit of the crest; the value of this rise is ·7 inch, or about ·010 inch per hour. The fall is not so precipitous; the barometer appears to be *kept up* in this locality by the *first subordinate maximum* succeeding the crest, so that, at the epoch of sixty-eight hours after transit, the value of the reading is more than two inches higher than at sixty-eight hours before transit. At eighty hours after transit a precipitous fall commences, which continues during the next twenty-four hours, the mercury sinking ·36 inch, or about ·015 per hour. The fall afterwards continues, with two slight interruptions, answering to the subordinate maxima, until the close of the wave, 148 hours after transit."

The peculiar features of the mean curve, especially the difference between the initial and terminal readings, ·241 inch, combined with certain features exhibited by the "great wave," at its last return, has suggested the possibility of expressing numerically the departure from symmetry for any station that may be selected. This departure from symmetry is strikingly manifested by the observations of 1846, especially as we proceed from Brussels, the European nodal point, towards

Ireland and the north-west of Scotland, and is well seen in the series of curves, illustrating the author's report in the last volume of the Association Reports.

Three principal maxima characterize these curves on the 5th, the 9th, and the 12th of November; and the differences of altitude between those of the 5th and 12th, have been employed to indicate the deviation from symmetry in the direction already alluded to. The discussion of these differences, and the results deduced from them, form the third part of the report.

The author has laid down, on a map of the British Isles, these differences, and from them constructed a chart of the lines of equal deviation from symmetry—these lines range from ·100 inch—which passes north-west of the Channel Islands, proceeds towards the Isle of Wight, skirts the shores of Sussex and Kent, and passes through Ramsgate—to ·550 inch, which passes through Limerick, is slightly curved as it crosses Ireland, and proceeds nearly in a straight line across the Scottish Islands, to the north-west of Great Britain. The values of these lines express the *depression* of the maximum of the 5th below that of the 12th. Among these lines, the author regards the direction of that representing ·260 inch as the best determined. It appears to have passed near, and to the west of, Helstone, this station exhibiting a deviation of ·258 inch; it then proceeded along the coasts of Cornwall and Devonshire, crossed the Bristol Channel, entered Wales, and continued its course across Glamorganshire, towards Brecon, which it left to the north-west, as it rather abruptly changed its direction, and proceeded towards Gloucester, which it passed through. It appears to have undergone considerable inflexion, as it traversed the central parts of England, rising again towards Nottingham, which is removed ·025 inch from it to the west; it finally left the shores of England, at the south-eastern angle of Yorkshire, and entered on the German Ocean.

The author solicited attention to a feature which characterizes all these lines, especially the one just traced, viz., the decided inflexion they undergo as they pass over the land.

The chart exhibits *two* systems of inflexion, one being peculiar to Ireland and England; the general direction of the lines undergoing a change as the line of greatest symmetry is approached, the inflection being governed apparently by the masses of land; and the other to Scotland, the inflexion being very decided over the land northward of the Firth of Forth.

From the *single* instance discussed by the author, the result appears to be, that the symmetry of the barometric curve is departed from in a greater degree at *inland* stations; a greater difference between the points selected, being exhibited at such stations than at the sea coast on either side. The report closed with some remarks on the non-persistency of the *direction of these* lines of deviation from symmetry, and on the high probability that they revolve about the nodal point of the two principal systems of atmospheric waves, Brussels.

Lond. Athenæum, Aug. 1848.

On the Advantageous Use made of the Gaseous Escape of the Blast Furnaces of Ystalyfera. By MR. J. PALMER BUDD.

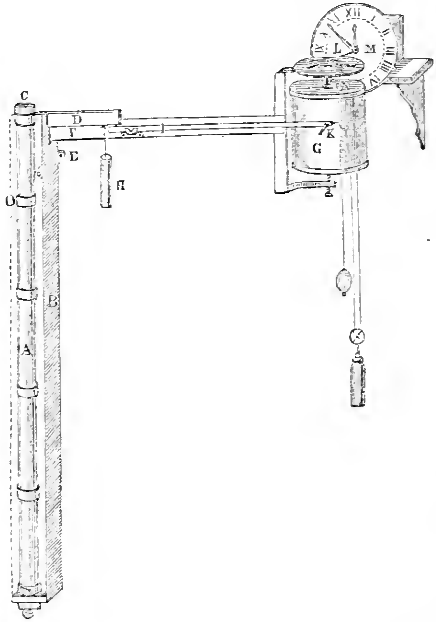
This communication drew attention to an economical application of the heated gases which are usually allowed to escape from the top of the iron furnaces. It appears that the gases which are evolved from these furnaces, escape at a temperature which is about the melting point of brass. In the iron works at Ystalyfera, where the iron is smelted by the use of anthracite coal, advantage has been taken of this in a most ingenious manner. By an arrangement, which is in its character exceedingly simple, but somewhat difficult to describe without a model, (Mr. Budd's description was illustrated by a very nicely constructed one,) the hot gas is led off into another channel, by means of a strong current, generated through a chamber and air-way, from a point just below the top of the iron furnace. It is conducted, very little heat being lost in the passage, under the boiler of a steam engine; and it is found to be at a sufficiently high temperature to heat the boiler, without the consumption of any fuel whatever. Hence an immense saving is effected. Although only one furnace, and one boiler, has hitherto been adapted to this purpose, it is found to effect a saving of £350 a year. We may consequently expect that, when the experiment is further extended, and more of the furnaces so arranged that this heat may be economized, and employed for the numerous useful purposes to which it is applicable in a large establishment, the saving will amount to many thousands annually. This communication is to be printed entire in the Transactions. Ibid.

On a Self-Registering Thermometer, with Twelve Months' Tracings of its Work. By M. HARRISON.

The principle on which the instrument acts, is the difference in the expansion and contraction of two metals, from the effects of heat and cold, and acting by the direct pull of the contracting metal, when it is kept in a straight line. It is made sufficiently powerful to overcome any resistance which the fulcrums of the levers, or the tracing pencil, may cause. I have selected cast iron and hard-rolled copper as the best suited for the purpose. I find, from tables published by Smeaton and others, that copper expands $\frac{1}{580}$ of its length, while cast iron only expands $\frac{1}{910}$, with a variation of 180 degrees of Fahrenheit's thermometer, which leaves a difference of about the $\frac{1}{1260}$ of its length; and as the range of the thermometer in the shade, in this climate, is about 90 degrees, or half of 180, I have the $\frac{1}{2520}$ part of the length of the copper bar employed as a moving power. I fixed upon a bar ten feet long, as being a convenient length; the two metals will then vary nearly the one-and-twentieth part of an inch, between the hottest day in summer, and the coldest day in winter. This variation I multiply by means of a compound lever, so as to get a sufficient scale to divide. The end of the last lever carries a pencil, which traces upon a revolving cylinder the variations that take place. In order to divide the scale

accurately, I procured a standard thermometer, by Messrs. Troughton & Simms. I placed it in the same situation, and made several observations in the day, for some weeks, in the spring of the year, when the range of the thermometer is the greatest. After I had got the scale properly divided, I engraved it on a plate of copper, in order to get a number of copies printed. The only attendance the instrument now requires, is to put a fresh paper upon the cylinder, by means of stretching screws fixed on one side of the cylinder, once a week, when I wind the time-piece up.

Self-Registering Thermometer.



A, copper bar, one inch in diameter, and ten feet long; B, cast iron trough, to which the copper bar is made fast at the bottom; C, brass cap. soldered fast to the copper bar, with knife edges on the under side, which rest on the tubular end of the first lever D, its fulcrum rests on the upper end of the cast iron trough B; E, flanges to bolt the trough to the outer side of a wall, near the angle of a room; F, part of the cast iron trough which passes through the wall into the room, carrying the fulcrum of the second lever I, and to which the revolving cylinder G is fixed; H, a weight to keep the first lever D steady on its bearings, and to counterpoise the second lever I; K, tracing pencil; L, a screw working in the edge of the wheel M, and coupled to the minute hand of the time-piece, making one revolution in an hour; the wheel M is fixed to the axis of the cylinder, and has 192 threads cut in its edge, and would make one revolution in eight days; N, a binding screw, to adjust the pencil to the proper hour line, when a fresh paper is put on

once a week; O, brass rings, made fast to the cast iron trough, to keep the copper bar steady, but through which it can move; the dotted line shows the side of the iron trough.

The instrument acts by the difference in the expansion of copper and iron, that difference being multiplied about 120 times, by a compound lever. The scale was obtained by placing in the same situation a standard thermometer, by Messrs. Troughton & Simms, for several weeks, in the spring of the year, when the range is the greatest, and making a great number of observations each day.

Tabulated results for the year 1847, *taken from tracings by the Instrument described.*

General mean of the whole year, . .	47·89
" of January, . . .	36·61
" of April, . . .	44·13
" of July, ...	61·80
" of October, . . .	49·35
Highest single observation, 1st August, . .	80·00
Lowest single observation, 13th February, .	22·00

Prof. Lloyd observed, that he much feared, as the indications of this thermometer were derived from the unequal expansion of different metals, magnified by a system of levers, that the bearings of the levers would be found not to move continuously, but by starts.

Sir W. S. Harris thought it likely some correction would be required for the hygrometrical state of the paper on which the curves were traced, as well as for the effects of changes of temperature of other parts of the instrument.

Prof. Lloyd, having been requested, by several members, to describe a barometer on a new principle which he had lately seen, said that it was a French invention. A cylinder of copper, with a very thin and corrugated end, was partially exhausted and hermetically sealed; and the effect of the varying pressure of the atmosphere, on the thin end, was magnified by a system of levers, so as to affect the index of a dial, very little larger than a watch dial. A friend of his had tested the indications of the instrument, by placing it under the receiver of an air pump, and observing its march, in comparison with the indications of the long gauge, and found them to agree to less than the 1-100th of an inch.

Mr. Jenkins mentioned some remarkable cases of the discrepancy of the indications of a number of compared thermometers, ranged along a wall at short distances, and at intervals of a quarter of an hour.

Ibid.

On some New Relations of the Diamagnetic Force. By Prof. Plücker.

Mr. Plücker gave a short account of experiments belonging to a new magnetic action. A crystal with one optical axis, being brought between the two poles of a magnet, there will be a repulsive force, going out from each of the poles, and acting upon the optical axis. According to this action, the crystal, if suspended, will take such a position, that its optical axis is placed within the equatorial plane. When the

crystal has two optical axes, there will be the same action on both; according to which, the line bisecting the acute angle formed by the axis will turn into the equatorial plane. When the crystal is suspended in such a way, that it may freely move round any line whatever of the plane, containing both axes, this plane will take the equatorial position. Thus a crystal, being neither transparent, nor showing any trace of its crystaline structure, we may, by means of a magnet, find the optical axes. At the same time we get a new proof of the connexion between light and magnetism. When light is passing through a crystal, there are in general two directions, where it is effected in a quite distinct way,—these same directions are acted upon by a magnet.

Prof. Faraday contrived to convert two raw potatoes into representatives of the poles of an electro-magnet, and, by a slice of another, with a quill stuck through it, represented the magnetic or diamagnetic crystal with its optic axes—and thus contrived to convey a distinct idea of the exact results of Prof. Plücker's discoveries of the relations of the optical axes of the magnetic and diamagnetic crystals, and the changes of distance, to the nature and laws of the attractions and repulsions exhibited under the several circumstances detailed.

Sir W. S. Harris considered that the laws of magnetic forces, in relation to the action of magnets on each other, or a magnet on a mass of common iron, were liable to vary, from the changes which arose in the amount of inductive action of which the attracting bodies were susceptible. He had shown, in a paper in the *Edinburgh and London Philosophical Transactions*, that, in electricity and magnetism, the amount of inductive disturbance was limited,—so that, after a certain time, under given conditions, the disturbance became the greatest possible, and then the law of the force changed; and hence arose all the irregularities which had embarrassed early inquirers into the subject. In fact, the force between a magnet and a simple mass of iron varied in a simple inverse ratio with the force induced in the iron, and with the disturbance conjointly. If either of them became constant, the whole force varied with the other. If, therefore, it should happen that, as the disturbance in the iron approached a limit, the changes were not uniform, then we obtained irregular results. So long, however, as the induced force went on uniformly, we had the total or absolute force in the inverse ratio of the squares of the distances. In the case of two magnets magnetized, or nearly so, the force of attraction between them varied in the inverse ratio of the simple disturbance, because the amount of the induced force had been reached. On this principle it was found, that in the repulsive force between the two magnets, the repulsive action at certain distances became changed into attraction; and it is not an uncommon circumstance, to find two magnets attract at one distance, and repel at another.—These results, he thought, might be applied in explanation of some of the phenomena now under consideration. The force of magnetic action might vary, whilst the diamagnetic force, after all, may have been constant.

Dr. Lloyd inquired if Prof. Plücker had tried whether crystals with

positive axes, exhibited any difference in the laws of diamagnetic action, from those which had negative axes?

Prof. Faraday replied, that Prof. Plücker had minutely investigated this point, and found no diversity of law corresponding to this difference in optical structure.

Sir D. Brewster inquired whether Prof. Plücker had investigated the influence which changes of temperature produced in the diamagnetic action of crystals? Some of these changes, he conceived, were of such a nature as to afford an admirable test, whether the same circumstances in the corpuscular constitution of the crystal, on which their optical characters depended, were those which gave rise to their diamagnetic relations, or not. For example, in some of the biaxal crystals, as sulphate of lime, when heated, the axes approached, and at length coincided,—the crystal becoming monaxal; and by continuing the heating, they again separated in a plane at right angles to the one in which they before lay. Such a series of changes, he conceived, if examined in relation to the diamagnetic forces, might afford a test whether the curious properties discovered by Prof. Plücker, had their origin in the chemical constitution of the bodies, or in that corpuscular structure from which their optical properties originated.

Prof. Plücker replied, that he had not tried the class of experiments pointed out by Sir D. Brewster; but he admitted their importance, and expressed a determination to pursue the inquiry.

Prof. Grove inquired whether the experiments were tried with the crystals placed in vacuo?

Prof. Plücker replied no; but in every case they were suspended either in air or in water.

Prof. Grove pointed out the necessity of caution in that case, as it was well known that differences between the diamagnetic actions of suspended bodies, and of the surrounding medium, would sometimes mask, and even reverse the action.

Prof. Faraday pointed out the precautions which had been taken to avoid this source of error. Ibid.

On the Submergence of Ancient Land in Wales; the Accumulation of newer Strata around and above it; and the Re-appearance of the same Land by Elevation and Denudation. By Prof. A. C. Ramsay.

This communication was illustrated by a section, on a true scale, of the rocks near Builth, in Radnorshire, where the Wenlock shales rest unconformably on the Llandeilo flags. The lower rocks must have been elevated previously to the formation of the upper, and their upturned edges must have been worn away by the sea, when the upper rocks were deposited, or previously. No power is known to exist far below the level of the sea, by which this process could have been effected; it must have taken place at the sea's level.

Throughout Wales, the Lower Silurian rocks appear to have been disturbed at one particular period—to have been heaved above water, and formed a coast, around which the succeeding rocks were accumu-

lated. Near Bishop's Castle, the upheaval of the Llandeilo flags was followed by the deposition of the Caradoc sandstone, which is full of pebbles of the older rocks. After this, a subsidence appears to have taken place, the area of the sea was increased, and the Wenlock shale was deposited, not only over the Caradoc sandstone, but beyond it, as at Builth, upon the Llandeilo flags; and in some places the shale rests on Greenstone rocks, and certain pebbles from it, being in fact a gravelly sea bottom. This depression of the bed of the sea continued also during the deposition of the Ludlow rocks, which are conformable to the Wenlock shale; and there is no marked alteration in the organic remains of the two rocks. The Wenlock shale is 1500 feet thick, and the Ludlow rocks 3500 feet; and as it is certain that their organic remains could not have existed at the depth of 5000 feet, we must suppose a gradual subsidence of the area, such as is believed to be now taking place amongst some of the coral islands, until 5000 feet of rocks was accumulated over what had been dry land.

The old red sandstone, which has a maximum thickness of 8000 feet, appears also to have extended over this country, judging by the outliers, at a considerable distance to the north and west. Subsequently, the whole of this series, from the Caradoc sandstone upwards, was removed, and the ancient Silurian strata became the surface of dry land, as they had been so long before.

It now became a question, what amount of alteration may the Silurian rocks have undergone, during the time they were so covered up? If the same laws regulated the ascent of the internal temperature as at present, namely, 1° for every 54 feet, then the addition of 5000 feet of rock would have raised the temperature by 92°, whilst 9000 feet would have added 160°, and with 11,000 feet of superincumbent strata, the Lower Silurian rocks must have endured an increased temperature of 212°. To influences of this kind may, perhaps, be attributed the crystaline or metamorphic condition of some of the more ancient rocks,—as suggested by Sir J. Herschel, in a paper communicated years ago to the Geological Society of London.

The Dean of Westminster referred to the Portland rock, in which a bed of vegetable soil occurs, full of trunks of trees, and cycadites; this bed rests on limestone containing ammonites, and is covered by similar marine deposits. Again in the Weald, fossil forests, and beds of freshwater shells are found above marine accumulations, and followed by the greensand and chalk. At the present time we find peat, and antlers of the red deer, in the bed of the channel, several miles off Swansea. On the Norfolk coast, and in the English Channel, are found the bones of the elephant, and fossil wood, disinterred from former cliffs by the action of the sea. These, with many other circumstances, were quoted as showing that, whilst the sea-level was fixed, the land had suffered depressions and elevations at many periods of time.

Prof. Phillips pointed out the extent of some of these subsidences of the land; for example, the old red sandstone, 8000 feet thick, all formed in shallow water, and the coal measures 11,000 feet thick, and added under similar circumstances; and inquired what condition of the interior of the earth can have admitted of the gradual subsidence of such great masses of strata? According to Mr. Hopkins's statement,

it was improbable that the interior would *now* admit of it. With respect to the augmentation of temperature which would follow on the addition of several thousand feet of strata, it should be remembered that the communication of heat from below, through such rocks, was remarkably slow; and the law of the distribution of internal temperature could not be assumed the same in ancient as in modern times.—As to the level of the sea remaining unchanged, this was only assumed for security in geological reasoning; there was evidence in the Malverns of a sea-level 600 feet above the present, but it was impossible to say whether that ancient level was nearer the *centre of the earth* when formed than now.

Lieut. Col. Portlock communicated some observations on apparent changes in the level of the coast near Portsmouth, and contended that, as these evidences of subsidence could be traced back to the most ancient times, so they had continued up to the present day, and expressed his conviction that a parallel might be found in existing nature to all the phenomena of ancient times. It appears that Fort Cumberland, near Portsmouth, stands on a bank of gravel and sand, and that, owing to some new wall made to protect it from the sea, a fresh direction was given to the tide, and a portion of the bank undermined and washed away, in the course of which a thick plank with a bolt was discovered, showing that the basis of the fort had no great antiquity. An artesian well has also been made to supply Blockhouse Fort, which shows, for the first 60 feet, nothing but clean shingle, and then a layer of sandy clay, full of common oyster shells.

Prof. Oldham exhibited a section of the hills known as the Chain of Kildare, in Ireland,—a low range, running N. E. and S. W., amidst bogs and flat country. They consist of a great mass of trap, succeeded by alternating slates, sandstones, and trap, calcareous rocks, shales, slates and sandstones,—all forming one conformable and regular series, elevated at an angle of from 45° to 70°. Resting on the edges of these rocks, and filling up the hollows, is the conglomerate of the old red sandstone, succeeded by the carboniferous limestone. On the flanks of the hills, and rising nearly to their summits, is a great deposit of modern drift, attaining a thickness of 200 feet in sheltered places. The section afforded evidence of several periods of elevation above, and depression beneath, the level of the sea; and it was alleged to be an object with the geologist, to map the surface of the land at each period of the earth's history.

Prof. Ramsay remarked, that he had not intended to imply that the level of the sea remained absolutely the same, as every deposit in it must raise its level; but he wished to protest against the doctrine, that the ancient sea-beds and beaches, high above the sea, in South America, and elsewhere, had attained their altitude through any subsidence of the sea, instead of the elevation of the land.

Mr. Greenough contended that the level of every sea, and of the ocean, was constantly undergoing changes.

Mr. Benson alluded to the occurrence of ripple-marked sandstones, in the Pennant grits of South Wales, which indicated a subsidence of those beds from near the sea level, to a depth, in some places, of 2000 feet.

Ibid.

On the Peculiar Cooling Effects of Hydrogen and its Compounds, in Cases of Voltaic Ignition. *By* W. R. Grove, Esq.

This communication was illustrated by an experiment, in which it was shown that a platina wire, rendered incandescent by a voltaic current, was cooled far below the point of incandescence when immersed in an atmosphere of hydrogen gas. This remarkable cooling property of hydrogen, of course, became the subject of experimental examination, in comparison with other gaseous media. By a very ingenious arrangement, tubes, containing coils of platina wire, were filled with hydrogen and other gases, and then being plunged into water in which delicate thermometers were placed, the wires were traversed by the same current from the battery, and it was found that the water was always more heated in a given time, by the wire in the tubes of oxygen, nitrogen, carbonic acid, carburetted hydrogen, &c., than by that in the tube containing pure hydrogen. It became necessary now, to ascertain the cause of this peculiar phenomenon of hydrogen. It was found not to be due to specific heat, nor to the conducting powers of the gases. Convection did not explain the fact; and considerable difficulty was found, upon examination, to exist, if it was attempted to refer it to the greater mobility of the particles of hydrogen gas, the lightest known, than of either oxygen, nitrogen, or carbonic acid. It was found that this peculiar property also belonged, but to a less extent, to all the compounds of hydrogen and carbon.

A discussion followed, in which Dr. Williams, Col. York, Prof. Graham, and Mr. Hunt joined.

Prof. Graham mentioned the curious fact, observed by him in his researches on the diffusion of gases, that the hydro-carbons move through tubes with great velocity, and that ether vapor, which is four times the density of hydrogen, moves, notwithstanding its weight, at four times the rate of other gases. It was thought this would, perhaps, serve to indicate the path in which an explanation might be looked for.

Mr. Hunt drew attention to the fact, observed by Prof. Graham, that ether vapor had the power of preventing the combustion of phosphuretted hydrogen and of destroying the luminosity of phosphorus, and thought the phenomenon observed by Mr. Grove, connected itself, in some way, with these curious properties of the hydro-carbons. Ibid.

On the Action of the Red, Orange, and Yellow Rays, upon Iodized and Bromo-Iodized Silver Plates, after they have been affected by Daylight, and other Phenomena of Photography. *By* M. Claudet.

It was shown by MM. E. Becquerel and Gaudin, that a photographic image on a Daguerreotype plate, might be developed by the action of the light which permeates yellow and red glasses, without the aid of mercurial vapor. M. Claudet has been continuing his researches on this point, and he confirms those results in a very striking manner. Numerous specimens were exhibited, in which it was shown that the

powers of the so-called *continuating rays*, in developing the image, were not much inferior to the mercurial vapor—presenting a positive image like it, but differing from it in the tint by which it is suffused. M. Claudet suspects that this result is owing to the decomposition of the iodide and bromo-iodide of silver, by the least refrangible rays—and that the whites are represented by finely-divided silver in the place of mercury. The rate of action, when the chemical agency permeates these colored media, is infinitely reduced for these preparations; but still it is evident, that some of the photographic principle permeates them—and also, that these rays which correspond in color with those media, have a peculiar scale of action of their own. Ibid.

On the Influence of Light in Preventing Chemical Action. By Mr. R. Hunt.

Bearing on the same subject as that brought forward by M. Claudet, although differing, inasmuch as one set of experiments were made upon iodized silver plates, and the other upon iodized photographic paper, this subject was taken by the Section, before any discussion was allowed on the preceding communication. Mr. Hunt having called attention to several experiments, in which certain luminous rays had been found to protect photographic agents from chemical change, —particularly in the researches of Sir John Herschel,—proceeded to describe his own experimental investigation of this subject. Taking a piece of highly sensitive photographic paper, which would blacken in a few seconds by the light of an argand gas burner, he threw upon it a condensed spectrum, which had been previously analyzed by a peculiar yellow medium—and then, by means of a mirror, reflected the strong light of the sun upon the paper. It was, therefore, under the influence of the unaltered reflected radiations—and also of the spectrum, from which the chemical agency had been, as nearly as possible, separated. The result was, that the paper was blackened over every part, except that portion upon which the strong line of spectral light fell, which was protected from change, *and preserved as a white band* in the midst of the darkened paper. This experiment was thought, by the author, strongly confirmatory of the view which he had taken, that actinism, or the chemical principle, and light, so far from being identical, are opposed in action to each other. Ibid.

On the Effect of the Rapid Motion of the Observer on Sound. By Mr. Scott Russell.

Until the existence of the very high velocities now given to railway trains, no opportunities have existed of observing any phenomena, in which the velocity of the observer has been sufficient to affect the character of sounds. The author, having had occasion to make observations on railway trains moving at high velocities, has been led to notice some very curious effects in sounds heard at 50 and 60 miles an hour. These effects are not heard by an observer who is stationary.

He found that the sound of a whistle, on an engine stationary on the line, was heard by a passenger in a rapid train to give a different note—in a different key from that in which it was heard by the person standing beside it. The same was true of all sounds. The passenger in rapid motion heard them in a different key, which might be either louder or lower in pitch, than the true or stationary sound.

The explanation of this was given as follows:—The pitch of a musical sound is determined by the number of vibrations which reach the ear in a second of time—32 vibrations per second, of an organ pipe, give the note c, and a greater or less number give a more acute sound, or one more grave. These vibrations move with a velocity of 1024 feet per second, nearly. If an observer in a railway train move at the rate of 56 miles an hour, towards a sounding body, he will meet a greater number of undulations in a second of time than if at rest, in the proportion which his velocity bears to the velocity of sound; but if he move away from the sounding body, he will meet a smaller number in that proportion. In the former case, he will hear the sound a semi-tone higher, and in the latter a semi-tone lower, than the observer at rest. In the case of two trains meeting at this velocity, the one containing the sounding body, and the other the observer, the effect is doubled in amount. Before the trains meet, the sound is heard two semi-tones too high, and after they pass, two semi-tones too low—being a difference of a major third.

There were next explained, the various effects which the noises of a train produced on the ears of passengers at high velocities. The reflected sounds of a train, from surfaces like those of bridges across the line, were, at ordinary velocities, sent back to the ear changed by less than a semi-tone, so as to cause a harsh discord, which was an element of the unpleasant effect on the ear when passing a bridge. In a tunnel, also, the sounds reflected from any irregularities in the front of the train, or behind it, were discords to the sounds of the train heard directly. He showed, however, that, at a speed of 112 miles an hour, these sounds might be those of a harmony with each other, and become agreeable, for the sounds reflected in opposite directions would have the interval of a major third.

Sir D. Brewster observed, that in his opinion, the explanation of the curious effect of rapid motion of the observer on sound, was to be sought from physiological causes, and not acoustic; and pointed out what he considered to be analogous phenomena with respect to light—such as the augmentation of light at the boundary of moving shadows, the perfect clearness with which objects could be seen through rapidly moving openings in screens, and the production of color by screens in motion under certain circumstances.

Sir W. S. Harris conceived that all the effects were to be explained by the undulatory theory of sound, in the manner in which they were explained by Mr. Scott Russell. Ibid.

／JOURNAL

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FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1848.

AMERICAN PATENTS.

List of American Patents which issued in the month of September, 1847, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Scrubbing Brushes;* C. J. Abels and R. M. Bicknell, Philadelphia, Pennsylvania, September 4.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner of manufacturing the fibres of the piassaba into brushes: viz., softening the same until they can be bent double without breaking, folding the bunches thereof at their centres, and inserting and securing the same, while in a wet or moist state, in the respective holes in the brush stock, by means of a cord, manufactured and prepared substantially in the manner, and for the purpose herein set forth. We also claim the method of manufacturing and preparing the cord, substantially as herein described, for the purpose of enabling us to work the bunches of piassaba in a wet or moist state, as herein set forth."

2. For an *Improvement in the Construction of Vessels;* John H. Fellows, Cincinnati, Hamilton county, Ohio, September 4.

The patentee says,—"The nature of my invention consists in the use of stout longitudinal planking, united by iron rods passing through the planking edgewise, starting from the keel, through the bottom and side planking, and also through the deck beams; and then secured by

nuts, to be screwed down so as to bring the deck beams and planking firmly together."

Claim.—"What I claim as new, and desire to secure by letters patent, is the application of rods of iron, passing through the longitudinal planking, and screwing them together, thereby dispensing with the timbered frame, as is required in the present mode of constructing hulls of vessels."

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3. For an *Improvement in the Manufacture of Soap;* John Shugert, Elizabeth, Allegheny county, Pennsylvania, September 4.

The patentee says,—"Take two pounds of sal soda, and two pounds of raw turpentine, half a pound of slacked lime, previously steeped about twenty-four hours in water, to remove its caustic or burning properties. To the above I add one pound of brown sugar. This composition I put into a vessel, with about two gallons of water, and boil it about half an hour, when it will have become a good soap for cleansing articles, and forms an excellent basis for the saponaceous compound;—to which I add about ten pounds of common soap, and boil the whole compound about two hours, or until it will produce the required bars of soap. I then pour the compound into suitable coolers, and when cooled, I cut it into the required bars for use, when it will be found to be the best soap for cleansing articles, ever known or manufactured."

Claim.—"What I claim as my discovery, and desire to secure by letters patent, is the before described composition, producing a saponaceous compound for cleansing clothes and other articles."

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4. For an *Improvement in the Construction of Lime Kilns;* Jacob H. Bower, Walnut, Juniata county, Pennsylvania, September 4.

Claim.—"Having thus fully described my invention, I do not claim the peculiar manner of laying the stones, in order to form conducting passages, or channels, for the diffusion of the heat, as I am well aware such disposition or arrangement has been made, in the setting of brick kilns; but what I do claim as my invention, and desire to secure by letters patent, is combining such arrangement, or disposition of the lime stone, with a temporary casing, or kiln, in the manner above specified, by means of which I obviate the difficulty and expense incurred in the erection of a permanent kiln."

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5. For an *Improvement in Preparing India Rubber, for the Manufacture of Water Proof and Elastic Goods;* James Thomas, City of New York, September 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of the acids of sulphur, of a lower degree of oxygenation than the sulphuric acid, in combination with suitable basis; but prefer a hyposulphite which can be used alone, or in combination with the other salts of the acids of sulphur, as described, or

with the sulphurets. I claim the use of artificial sulphuret of lead, used either alone with the india rubber, or mixed with a salt of lower degree of oxygenation than a sulphate, but prefer using a mixture of about equal parts of a hyposulphite and artificial sulphuret of lead, as before stated."

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6. For an *Improvement in Feed Rollers for Carding Machines, &c.;* H. G. Ellsworth, Enfield, Hartford county, Connecticut, September 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the fluting with the screw thread, or groove, on the surfaces of feed rollers, thereby forming teeth, which straightens the fibres, and more effectually prevents lapping."

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7. For an *Improvement in Baby Jumpers;* G. W. Tuttle, City of New York, September 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining of a spring, or springs, with a suspended apparatus, for exercising children and invalids; it being understood that my claim is limited to the combination of such spring, or springs, and suspensory apparatus, as will enable the child to bring its feet conveniently in contact with the floor, while its body is suspended, substantially in the manner described; not intending, however, by the foregoing description and claim, to limit myself to the exact form, or mode of uniting any of the parts, of the apparatus, but to vary the same as I may think proper, whilst I attain the same end by means substantially the same."

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8. For an *Improvement in Preparing Wool and Cotton for Carding;* George L. Mason, Williston, Chittenden county, Vermont, September 4.

The patentee says,—"The nature of my invention consists in providing a steam box, underneath the apron that conveys the material to be carded to the carding machine, which box, in shape, is adapted to the apron, and is provided with valves upon its upper side, for the escape of steam at the pleasure of the operator."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of heat and moisture, by means of steam, to cotton, wool, and other material, preparatory to carding and manufacturing."

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9. For an *Improvement in Making Mattrasses;* Charles L. Fleischman, City of Washington, D. C., September 4.

The nature of this invention consists in preventing horse hair, sheep's wool, moss, hair, tow, feathers, corn husks, and all such materials, except cotton, which have hitherto been used for making mattrasses, cushions, and all kinds of upholstering work, from matting, by the in-

terposition of layers of glazed cotton, or cotton batting, confined between paper, cloth, or other like materials, and thus combining materials of a strong, with others of a more delicate, texture.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is, first, placing between layers of horse hair, moss, or any of the specified materials, layers of cotton batting, either confined between cloth, paper, or any suitable fabric, or cotton batting glazed on both sides, or simply calendered, as above described.

"2d. I claim the mode of making mattrasses, suitable for winter and summer use, substantially as herein set forth."

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10. For an *Improvement in Manufacturing Sugar;* Antoine Marie Felix Chevet, St. James' Parish, Louisiana, September 4.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the employment of soluble saccharate of lime, instead of lime in its native state, and the employment of an agent which may take off the lime after its action, without leaving anything soluble in the saccharine liquor."

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11. For an *Improvement in Stove Grates;* Geo. A. Phillips, City of New York, September 4.

Claim.—"I do not claim to have invented any of the parts herein described, by which the construction of the shaking bar, and the combination thereof with the levers, gives a lateral and horizontal movement at the same time, with a slight vertical rock to the grates, to shake down the ashes; nor do I know of any arrangement similar to that by which the slide bar and levers will both let down the grate, to empty the fuel or cinders, and afterwards replace the grates for use, without opening the stove, or furnace. Therefore I claim as new, and of my own invention, the application, constructive arrangement, and combination of these parts, for these purposes, substantially in the manner described."

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12. For an *Improvement in Type Casting;* George Bruce & Co., assignees of William P. Barr, City of New York, September 4.

Claim.—"I claim as my invention, and desire to secure by letters patent, the lever, working in a slot in the arm of a machine for casting printing types, on a pin passing through the arm, and across the slot in the plane of the face of the matrix, or below it; the forked or double acting slide, by which the lever is controlled and worked; the attachment of the spring to the lever, so that it shall be moved entire with the matrix, and diminish in pressure at the moment of discharging from the type, or the attachment of the spring to the matrix holder, for the same purpose; the matrix holder, with its tightening and regulating screws, and also the matrix holder with one arm, and a fixed shoe, in which the matrix may be confined, or allowed to move, and the holder may be allowed to move, or be confined; and the arrangement and combination of these parts as here described, or varied to

suit another machine, or hand-mould, for casting printing type, so as to move the matrix to and from the mould, and to discharge it from the type nearly perpendicularly, or at any suitable angle without using the edge of the mould for a fulcrum."

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13. For an *Improvement in Sash Fasteners;* Morton Judd, New Britain, Hartford county, Connecticut, September 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of fastening window sash, by placing the catch in the centre, longitudinally, of a box—said box having three of its sides and ends closed, the ends having a jog, or shoulder, upon which a bar, or curved spring, is arranged, against which the end of the turning catch is placed, which serves to keep the spring in its place, and the spring to secure the catch in the position which it is made to assume, without bolts or screws; the catch, being thus placed in the centre of the box, answers the double purpose of securing the spring to its place, without the expense of fastening it in the usual way, together with the convenience of fastening or unfastening the window, by turning the catch either to the right or left. Fasteners constructed in this way, can be made of steel metal, whereby they can be afforded at one-quarter less expense than the ordinary way of casting, and are much stronger, not being mortised for the binding screws that confine the spring to the box, and the spring being placed loosely in the box."

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14. For an *Improvement in Machinery for Spinning;* M. W. Obenchain, Springfield, Stark county, Ohio, September 11.

The nature of this invention consists, first, in giving to the first pair of draw rollers, that receive the rovings from the condenser, an intermittent rotary motion, when this is combined with the second and third pairs, made with their peripheries in segments, with the segments of one set placed at right angles to the segments of the other; so that, when the second set are drawing the rolls, or rovings, between them and the first pair that have an intermittent motion, the thread shall receive twist from the spindles to the second set, and when these have performed a portion of a revolution equal to one segment, and liberate the rolls or rovings, the other pair begin to draw, the twist given to the thread, from the points of the spindle to the second pair, is permitted to run up to the rollers that move with an intermittent motion, that the rovings may be partially twisted, the better to sustain the drawing operation.

The second part of this invention consists in giving a reciprocating motion to the guides, around which the rolls or rovings pass, between the condenser and the first pair of draw rollers that have an intermittent motion, for the purpose of taking up the slack made by the continuous delivery of the condenser, during the time that these rollers are not in motion.

The third part of this invention consists in giving to the guides, around which the rovings pass, an intermittent rotary motion on their

axis, corresponding with the intermittent motion of the first pair of draw rollers, to prevent the breaking of the rovings by friction, in passing around the guides.

And the last part of this invention relates to the mode of regulating the amount of twist to be given to the threads, by varying the ratch of the two pairs of segment draw rollers: that is to say, by varying the distance between these two sets of rollers, which, at the same time, varies the distance between the lower pair of rollers and the points of the spindles; this being effected by mounting the lower pair of draw rollers on slides, so that, by means of a rack and pinion, they can be moved up or down, the cog gearing which communicates motion from one of the pairs of segment rollers to the other, being connected by joint links, so as to retain the cog wheels at their true pitch, as the distance between the draw rollers is varied.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is, first, giving to the first set of draw rollers an intermittent motion, in combination with the second and third sets of draw rollers, made with segments to draw alternately, substantially as described. 2d. I claim giving to the series of guide rollers an intermittent reciprocating motion, to take up the slack of the roving, and then to give it out, substantially as described, in combination with the intermittent motion of the first set of draw rollers, as described. And I also claim, in combination with this, giving to the guide rollers an intermittent rotary motion, to prevent the breaking of the rovings by friction, as described, And finally, I claim hanging the third set of draw rollers in a sliding frame, substantially as described, provided with the requisite mechanical agent for moving it during the operation of spinning, whether this be rack and pinion, or other mechanical equivalent, whereby the amount of twist to be given to the threads that are being drawn and spun between the rollers, can be regulated at pleasure by the attendant, as described."

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15. For an *Improvement in Carriages, &c.;* Chas. J. Woolson, Cleveland, Ohio, September 11.

The nature of this invention consists in placing the beam of the carriage body, and its contents, upon the axle, very near the wheels, in a simple and improved manner.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is connecting the "cradle spring," so called, or the single steel spring, similar in form to the half of an elliptic, to the forward axle of four-wheeled carriages, or wagons, at points near the hub, so as to have the spring form the rocker, and turn with the axle, and transfer the weight from the middle to the ends of the axles, as described, when this is combined with the body of the carriage, by means of the fifth wheel attached to the spring, as described."

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16. For an *Improvement in Burring Machines;* Ziba Parkhurst, City of New York, September 11.

Claim.—" What I claim as my invention, and desire to secure by let-

ters patent, is, 1st, the combination of the receiver, stripper, middle clearer, middle stripper, top stripper, hoppers, and shell, whether arranged in the manner described, or in any other mode which is substantially the same, by which results analogous to those described are produced.

"2d, I claim the zig-zag angular strippers as set forth, and generally, whether used in combination with a cylinder constructed like this cylinder, or a cylinder constructed in any other form.

"3d, I claim the combination of the shell with the receiving cylinder, for pressing the wool against the cylinder, and protecting it from the dirt thrown off by the strippers, whether made in the manner described, or in any other mode or manner which is substantially the same."

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17. For an *Improvement in Lithographic Presses;* John Donlevy, City of New York, September 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The placing a half box of metal, to act as a bearing to the axle of the cylindrical roller upon the bed frame, either to it, or detached from it, and the placing the same upon the platform to receive a machine without the bed frame, without any opening, cavity, or groove, in the bed frame or platform, to receive it.

"2d, I claim the forming of the arch, in the manner and variety of form described, with cavities to receive the axle of the cylindrical roller, and the half box on which the same is situated, or with cavities, or openings, to receive detached boxes for the axles, or the axles without boxes, either cast in the feet, or other part of the columns, and also to receive the screw and eccentric when used. But I do not claim as my invention, the form of the cavities, or projections, on the crown of the arch intended for the lever box, screw, and spiral spring, nor the use of ways attached to the inner side of the columns."

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18. For an *Improvement in Steering Apparatus for Steering Vessels;* Isaac L. Blanchard, Weymouth, Norfolk county, Massachusetts, September 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of chains, two windlass barrels, cogged wheels, and purchase wheels and shaft, as applied to the rudder head, in manner and for the purpose specified. I further claim the combination of the index pointer, or apparatus, with the rudder head, for the purpose of denoting the direction of the rudder, when the tiller is removed, all as specified."

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19. For an *Improvement in Catches for Clasps;* James Bingham, Philadelphia, Pennsylvania, September 11.

The patentee says,—"The nature of my invention consists in constructing the catch, or coupling joint, in the form of a hinge, the pin, or wire, by which the male and female portions of the hinge are con-

nected, being firmly fastened to the male portion of the hinge, the female side being furnished with a slot in the upper part of the connecting portions of the joint, through which the male part of the joint can slide laterally, when thrown back over the female side of the catch, carrying the pin with it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is fastening the pin, or wire, of the hinge catch, or coupling joint, firmly to the male side of the hinge, in combination with the longitudinal slot through the female portion of the joint, in the manner described."

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20. For an *Improvement in Fountain Pens;* Moses F. Hoit, Livingston, Sumpter county, Alabama, September 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the pen with the fountain, in such a manner that the tapering part, or the nibs, of the pen may serve as a valve, or valves, to the orifice, or orifices, which, being opened by the downward pressure in writing, allow the ink to flow, while, at the same time, the ink is prevented by the depression, from being drawn up between the pen and the tube as described."

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21. For an *Improvement in the Construction of Chimneys;* John B. Kelsey, Newburyport, Massachusetts, September 11.

Claim.—"What I claim is, first, the combination of the air chamber, in rear of the back, and sides of the fire place, or any part thereof, with the inlet air pipes, or passages, and outlet pipe leading into the room, the said pipes having dampers, or valves, in the manner described; and for the purpose of distributing the heated air, and using part of it for the chimney, and part for heating the room. I claim the combination of the two separate chambers, and their respective inlet and discharge pipes, valves, &c., as arranged and made to operate substantially as described."

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22. For an *Improvement in Compositions for Lubricating Machinery;* P. Zieber, John Hancock, and Patrick S. Devlin, Reading, Berks county, Pennsylvania, September 11.

The patentees say,—"The nature of our invention consists of the following ingredients:—To thirty gallons of water, add ten pounds of carbonate of soda, two pounds of gum tragacanth dissolved."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination or admixture of the water, sal soda, and gum tragacanth, the ingredients herein named, for the purpose herein named."

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23. For an *Improvement in Smut Machines;* Jacob Brenner, Liberty, Tioga county, Pennsylvania, September 11.

The patentee says,—"The nature of my invention consists in di-

viding the case into several compartments, one above the other, by means of horizontal rings, that extend from the inner periphery of the case, to a wire gauze, or perforated cylinder, surrounding and attached to the shaft, the beaters being attached to, and projecting from, this perforated cylinder, and made to rotate within the compartments between the horizontal rings,—when this is combined with a system, or set, of feeding or discharging tubes, connected with the outer case, the first to discharge the grain in the upper or first compartment, which is there acted upon by the first set of beaters, carried entirely around, and discharged by centrifugal force into the second tube, through an aperture the whole height of the compartment; this discharges the grain into the second compartment, in the same manner as it was fed into the first, and after being acted upon in this second compartment, by the second set of beaters, and carried around, it is discharged into the third tube, which delivers it to the third compartment, and so on to the end, where it is discharged from the lower end of the last tube, in a trough, or spout, leading from a fan blower, on the lower end of the shaft of the beaters. In this way, the grain undergoes a succession of beating operations, in passing from one chamber, or compartment, to another in succession, the beating operation in each being guarded by the outward current of air that enters the wire gauze, or perforated cylinder, at each end, and which is forced out by centrifugal force, through the apertures of the casing, carrying out with it the impurities that have been beaten out, and finally, the remaining dust, smut, &c., is discharged, and carried off by the current of air from the fan blower, which crosses the grain as it falls."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the outer case of the machine in several compartments, one above the other, with the sets of beaters playing within them substantially as described, in combination with the tubes, or spouts, attached to the periphery of, and opening into, the outer casing, to conduct the grain from one compartment to another in succession, substantially as described. And I also claim, in combination with a casing so constructed as above claimed, the beaters attached to the periphery of a perforated or wire gauze cylinder, open at both ends, that the rotation of the beaters may induce a current, or currents, of air, outwards, to discharge the dust and other impurities, through the apertures between the bars of the outer case, and to aid in delivering the grain to the conducting tubes, substantially as described."

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24. For an *Improvement in Machines for Hoeing Land;* Moses Stafford, Georgetown, Essex county, Massachusetts, September 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of one or more of the cross pieces, and their rods or other equivalents, with the rotary hoes, the same being used in manner and for the purpose described."

25. For an *Improvement in Horse Rakes;* John M. Stafford, Pike, Wyoming county, New York, September 11.

The patentee says,—"The nature of my invention consists in dispensing entirely with the stop bars, as used in L. M. Whitman's rake, and providing an apparatus which shall not interfere with the free operation of the rake, and accomplish the same purposes by a new mode."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the shafts, or keepers, with the segments of the horse hay-rake, as above described; not intending, however, by this claim, to confine myself to the use of two shafts or keepers, but to make use of two or one, as I may think proper, while I attain the same ends by substantially the same means."

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26. For an *Improvement in Preparing Materials for Lemonade;* James Warren, Jr., City of New York, September 11.

The patentee says,—"For lemon sugar, lemonade sugar, or sugar of lemon,—

Take of powdered		loaf sugar, refined, 100 lbs.		
"	"	citric acid, as prepared above,		3 lbs. 14 oz.
"	"	rind or peel,	"	$6\frac{1}{2}$ oz.
"	"	pulp or mucilage,	"	$6\frac{1}{2}$ oz.

and let them be thoroughly mixed together, when it will be fit for use. One large table spoonfull of the sugar thus prepared, will be sufficient for a tumbler of water, which will contain acid, and all the other parts of the lemon, equal to the half of a medium sized lemon."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the above described composition, for making lemonade, the whole being prepared substantially as described."

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27. For an *Improvement in Machinery for Manufacturing Hinges;* G. H. Horton and L. Armstrong, Hartford, Connecticut, September 11.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the die, two impelling slides and chambers, and the turning die, the whole being arranged and made to operate together substantially as described. We also claim the wire feeding apparatus, in its combination with the dies, or machinery, for making the hinge joint, and as arranged, and operating therewith, substantially as hereinbefore specified. We also claim the slide, or hinge-discharging apparatus, as combined with the dies, or apparatus for making the joint of the hinge, and operating therewith, as specified; and, in combination with the said dies, or apparatus for bending the parts of the joint of the hinge, we claim the slides, (by which lateral extension of the metal is prevented,) the same being made to operate therewith substantially as specified. We also claim the combination of the cutting slide, or part which severs the wire, with the bending apparatus, the same being actuated and arranged as described."

28. For an *Improvement in Coloring Plates for Artificial Teeth;* Morris Levett and Henry Davis, City of New York, September 18.

The patentees say,—"The nature of our invention consists, first, in providing a coating of japan, or other substances, to represent the color of the gum or skin of the mouth, and with this we cover the exposed surfaces and parts of the setting of gold, or other material, for fastening the artificial teeth, and holding them in place; by which the exposed parts are made to correspond in color to the skin of the mouth and gums, and thereby prevent the exposure of the settings, and fastenings, when the mouth is open. Secondly, in the preparing a varnish, or other material, and applying the same to the settings of artificial teeth, so as to cause them to represent the color of the mouth or gum."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the japanning, or otherwise covering, the setting or foundations of artificial teeth, in such manner as to disguise the setting, so as to represent the gum, or natural skin of the mouth, as nearly as possible, whether the same be effected in manner described, or by equivalents substantially the same. We also claim the herein described japan, or varnish, and the method of compounding and applying the same to the setting of artificial teeth."

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29. For an *Improvement in Hydrostatic Gas Stops, for Gas Pipes;* Joseph Battin, Philadelphia, Pennsylvania, September 18.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the respective parts thereof, so as to effect the purpose herein made known: that is to say, I claim, in combination, the use of a tank furnished with a partition, which shall operate as a water trap, or seal, and with a tube for supplying and drawing off the water, the gas being admitted into the upper part of the tank, and the whole arrangement and operation being substantially the same with that herein described. And I do hereby declare, that I do not claim either of the parts of which my said seal, or trap, is composed, as in itself new; but I limit my claim, as above set forth, to the particular arrangement of said parts, so as to adapt it to the performance of the office for which it was designed."

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30. For an *Improvement in Cooking Stoves;* James McGregor, Jr., Saratoga, New York, September 18.

The nature of this invention consists in constructing the lower flue of a cooking stove, which passes under the oven, of greater depth than usual, and making the division plate, between the oven and fire place, which may be called the check plate, or any other plate, at, or near, that end of the flue which leads into the rising flue, or exit pipe, so that it shall extend down below the bottom, to form a reservoir of hot air, extending from the bottom plate of the oven, down to the lower edge of the check plate, at the end of the bottom flue, the draught being all below the edge of this plate, so that the gaseous products of com-

bustion, air, &c., which enter the deep flue under the oven, will rise by rarefaction, and occupy the space between the bottom of the oven and the lower edge of this plate, and thus guard and protect the oven from being suddenly affected by changes in the fire chamber and flues. The invention also consists in making the draught aperture of such a flue, larger in the parts that are furthest from the exit pipe, and gradually reduced towards the pipe, for the purpose of equalizing the heat under the oven, for as the tendency of all currents is to rush in straight lines, from one point to another, it follows that, unless some impediment be interposed, the heat will be concentrated under that part of the opening which is nearest the exit pipe; but by gradually reducing the size of the aperture through which the draught passes, as it approaches the exit pipe, this tendency is checked, and the heated air, smoke, &c., is forced to pass mainly through the enlarged part, and thus to equalize the temperature under the oven.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making a reservoir in the upper part of the horizontal flue, under the oven, by means of the check plate, at, or near, the end of the flue, substantially as described. And I also claim making the draught aperture, in the check plate of such a flue, smaller near the exit pipe, or flue, and gradually larger as it recedes therefrom, substantially as described, whereby the smoke, and other products of combustion, are caused to circulate and pass under the entire bottom of the oven as described."

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31. For an *Improvement in Bridges;* S. F. Gassaway, Marietta, Cobb county, Georgia, September 18.

The patentee says,—"The nature of my invention and improvement consists in combining a number of parallel wrought iron suspension chains, and horizontal iron chords, with light timber frames arranged between them; such chains and chords being secured to horizontal parallel transverse iron bars, resting upon stone abutments and piers, for supporting the usual parallel strings, cross-ties, and iron rails, of a railway, forming, at once, a light, strong, durable, and cheap structure, adopted to plans when bridges of great span, strength, and economy, are required."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is uniting the successive spans of the bridge to each other, and causing them to co-operate, by the combination of the rods with the cross timbers, and the bolsters, or transverse plates, resting on the piers as herein set forth."

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32. For an *Improvement in Grinding Mills;* Joseph Pierce, Buffalo, New York, September 18.

The patentee says,—"The nature of my invention consists in providing a shaft, or shafts, having upon them one or more eccentrics, and one or more pulleys composed of metal, wood, other materials, or combinations of them, placed under the stone bridge trees, or bridge trees of all the spindles that are attached to the same motive power in the

mill, or upon levers upon which the traversing pins are placed, which traverse through the bridge tree, upon which the lower end, point, step, or foot, of the stone spindles stand, whether the stones are placed in line, or on a square frame or hearse."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application, by machinery, of eccentrics upon shafts, to the bridge trees of the spindles, or the levers of traversing pins, upon which the point, step, or foot, of stone spindles stand, and of straps, connecting the pullies upon the shafts to the shoes of the mill hopper, so that, by rotating the shafts by levers, wheels, or pulleys, the eccentrics elevate and let down the bridge trees and shoes simultaneously and conveniently, upon starting and stopping the mills."

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33. For an *Improvement in Printing Oil Cloth Carpeting;* James Albro, Jr., Elizabethtown, Essex county, New Jersey, September 18.

The patentee says,—"My improvement consists, first, in the mode of printing oil cloth, in spreading or extending all the colors, after being put on by print blocks in the ordinary way, so as to cover the ground, or face of the cloth, thereby preventing the colors of the cloth on which the printing is made, from showing through the spaces between the peg-work. Second, In common with the above, I have still further improved the method of printing oil cloth, by blending the various colors, by rendering the surface more smooth and level, and giving it the appearance of velvet carpeting."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the laying on to the printed oil cloth, as finished in the ordinary way, a block having pegs extending over its entire surface, with its pitches, or guide pins, so arranged that its pegs shall fall on the interstitial spaces left by the pegs of the other blocks, for producing contiguity of all the colors, without supplying additional colors. And second, by applying, in addition to the above, a block, cut into small continuous lines, which blends and softens the colors, and improves the effect—either of these blocks can be used separately or jointly. I hereby declare, that I do not claim to have invented what is known to oil cloth printers, as *raised work*, by which two blocks are used for one color; the pegs of the second block falling upon the interstitial spaces of the pegs of the first block, both being dipped in the same color.

"I claim the above mentioned improvements, whether they are effected in the manner set forth, or in any mode substantially the same, producing a like effect by analogons means."

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34. For an *Improvement in Gas Regulators;* Joseph Battin, Philadelphia, Pennsylvania, September 18.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner set forth, of combining the conical governor, or regulator, and the quicksilver seal, with the gasometer, so as entirely to cut off, or to govern and regulate, the pressure of the gas within the distributing pipes. I do not make claim to either of these devices,

when taken separately, and uncombined with the gasometer and inlet pipe, but I limit my claim exclusively to the aforesaid combination, for the purpose herein fully set forth."

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35 For an *Improvement in Machinery for Planing Metals;* Alfred C. Jones, New Orleans, Louisiana, September 18.

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular manner in which the slides, and the apparatus for moving them, are arranged and combined with each other, and with the bar, by which arrangement and combination said instrument is rendered portable, and capable of being attached to a work bench, or to the work on which it is to operate. I do not make claim to either of the individual parts, when taken alone, as of my invention,—slides, such as I have described, and the giving motion to them by means of screws, or of racks and pinions, being well known devices; I therefore, as above stated, limit my claim to the particular combination herein set forth, by which I have produced a tool which is substantially new, and of great utility."

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36. For an *Improvement in Moulding and Pressing Glass;* New England Glass Company, assignees of J. Magoun, East Cambridge, Middlesex county, Massachusetts, September 25.

Claim.—"What I claim, is the manner of making the foot of a glass goblet, or other article of like character, whereby I am enabled to manufacture it without the usual mould marks, or impressions of the mould, viz., by casting the said foot in the mould in the shape of a hollow cylinder, or inverted cup or bell-shaped, as described, or any shape approximating thereto, and in combination with, afterwards opening the same, or making it into a circular disk, by means as above specified. I also claim the hereinbefore described mode of making the mould, in order that the body part of it may be made in one piece, and without any side joint, or joints, by which any mark or impression of such joint, or joints, will be produced on the body of the glass article, in casting it in the mould; the said mode of making the said mould, being to construct the opening of the said bottom of the bottom, of a size sufficient to admit the shank and foot part of the glass article to be drawn upwards through it, as explained. I also claim the combination of the two series of cams, with the bottom plate, cam plate of the mould, and core of the foot, the same being for the purpose of elevating the glass casting from the core, or depressing the core from the said casting, in the manner set forth."

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37. For an *Improvement in Moulds for Pressing Glass;* New England Glass Company, assignees of J. Magoun, East Cambridge, Middlesex county, Massachusetts, September 25.

The patentee says,—"I make the mould in two or more parts, but with the upper part of it, or all that part of it above the flutes, like a

cylindrical ring, without any vertical seam. This ring I make to rest on the top of that part of the mould which constitutes the matrix of the fluted part of the glass article, the seam or joint of the two parts being made to correspond with the curve of the top of the flutes;—the piston or plunger of the mould passes down through the circular mouth, or opening. From the above, it will be seen that the interior of the ring is a hollow cylinder, without any vertical joint or opening, which can produce any impression, or injurious mould mark, on the outer surface of the cylindrical part of the fountain of the lamp, or whatever glass article of the kind may be cast."

Claim.—"What I claim is the ring, as combined with, and applied to, the body or fluted part of the mould, in manner and for the purpuse set forth."

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38. For an *Improvement in Preparing and Hardening Raw Hides;* Timothy Earle, assignee of H. Halvorson, Leicester, Massachusetts, September 25.

Claim.—"What I claim as my invention and discovery, is the process of treating the skin or hide of animals, or of thickening and converting it into a substance resembling horn, the same consisting of steeping or boiling it in an alkaline solution, an astringent solution, or an alkaline and astringent solution, and afterwards submitting it to the action of hot or boiling oil, as specified. And furthermore, as it may often not be desirable to full up, or thicken, the hide or skin, but simply to render it hard and semi-transparent, I claim to accomplish the same, by steeping or boiling it in an alkaline solution, and afterwards in a hot or boiling drying oil, as described."

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39. For an *Improvement in Window Blind Fasteners;* John L. Bassett, Bridgeport, Fairfield county, Connecticut, September 25.

The patentee says,—"The nature of my invention consists in providing a latch for a blind or shutter, or door fastening, with certain parts which connect it to the door plate. One of said parts is a set off on the edge or side of the latch, which I call a shoulder; this sets on the plate. Another one of these parts is a projecting branch, setting out some distance on the other edge of the latch, and rests on the plate. Another of said parts is a narrow strip, or prong, which is attached to the branch last mentioned;—this prong extends in a direction about parallel with the main latch, and is of a sufficient length to receive and guide the spiral spring, which is put around it, after that the latch is put through the mortise in the plate. When the spiral spring is around the prong, one end of it sets up against the plate, being secured there by fastenings, the other end to the edge of the latch. Another one of said parts for connecting the latch to the plate, is at the point ranging with the edge of the plate, which I call a notch; the centre of the notch sets against the edge of the plate, the under part of the shoulder first mentioned makes one side of said notch, and the other side of the notch is made by a jut."

Claim.—"What I claim as my improvement, and desire to secure by letters patent, is connecting the latch to the plate, by the notch and projecting branch, in combination with the prong and spring."

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40. For an *Improvement in Machinery for Turning Wooden Bowls;* Parley Hutchins, Jr., Washington, Hampshire county, Massachusetts, September 25.

The patentee says,—"The nature of my invention consists in turning bowls or dishes, from blocks of wood, or any other suitable material, by means of one or more knife, or knives, shaped in a curved form, and placed in a frame made for holding them, which frame being made fast to the middle of a semi-circular arm—said arm having cogs or teeth, which are operated upon by an endless screw, for the purpose of moving the said semi-circular arm and knife frame, up to the revolving block of wood, for the purpose of turning off bowls or dishes, as set forth."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the semi-circular arm with the knife frame, holding one or more knives, and adjustable piece, for holding the gouge, for the purpose of turning wooden bowls or dishes, and, in combination therewith, I claim the manner of regulating the thickness and size of bowls or dishes to be turned off, by means of the sliding or movable bottom, and the adjustable mandril and centre pin, for the purpose of turning wooden bowls or dishes in the manner set forth."

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41. For an *Improvement in Parlor Fire Grates;* E. Backus, Brooklyn, New York, September 25.

The patentee says,—"The construction is as follows:—In a common chimney piece a grate is set, the jambs of which are made hollow, the grate is furnished with two doors to increase the draught. Besides the ordinary outlet for the products of combustion, there are two others, one into each jamb, and when the throat of the grate is stopped, (which may be done by an ordinary lattice or other valve,) then the heat, smoke, &c., is turned into the side jambs, and passes out through a hole, in the front of the jamb, to which an oblique pipe is fitted, which conveys it into a radiator, or drum, in which there is a partition, that causes it to descend to near the bottom, thence it ascends, and passes back into the chimney, through another oblique pipe. These radiators, of which there are two, are four sided prisms, having any suitable ornament thereon, and are placed one on each side of the chimney piece; they stand on legs, and through them pass two or more pipes, open at top and bottom, through which the air of the room circulates. It will be seen that these radiators can be removed, when the weather is too warm to require their additional heat, and then the grate has only the characteristics of a common grate, and it is obvious that they can be replaced at pleasure."

Claim.—"What I claim as my invention, and desire to secure by

letters patent, is the combination of the removable radiators with a common open fire grate, substantially in the manner herein described, and for the purposes set forth."

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42. For an *Improvement in Propelling Railway Cars;* Ira Avery, Tunkhannock, Wyoming county, Pennsylvania, September 25.

The patentee says,—"The nature of my invention consists in providing air pipes, or tubes, made of a strong, flexible, and air tight material, such as leather, &c., placed lengthwise of the road—attaching to the cars, (or other body to be moved,) power or driving wheels, in such a manner as to run upon, or against, the pipes or tubes, and placed so near, as to stop or prevent the passage of the air at the point of contact. This arrangement being completed, the air is to be forced into the pipes, at the starting point, by means of steam, or other power, in any of the known ways of generating a current of air. The pipes being thus inflated behind the power or driving wheels, causes it to move forward as long as the current of air is kept up."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application to railroads, and railroad cars, &c., the air pipe and driving wheel, so adjusting them that, when the air is forced into the pipe, it will impart to the wheel bearing upon it, a rolling motion, producing a forward movement to the body to which the driving wheel is attached."

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43. For an *Improvement in Hot Air Furnaces;* Walter Bryant, Boston, Massachusetts, September 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the radiator, constructed for the circulation of the smoke, &c., throughout its interior, and arranged for the removal of soot, &c., from the same, substantially as described; and also the combination of such a radiator with the smoke drum of the furnace, substantially as set forth."

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44. For an *Improvement in Operating Cut-Off Valves;* Henry T. Peake, Charleston, South Carolina, September 25.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the working of the cut-off valve with the same eccentric and arm as the slide valve."

List of American Patents which issued in the month of December, 1842, with Exemplifications, by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Metallic Pens;* Thos. Woodward, Brooklyn, New York, December 1.

The patentee says,—"My pen holder is intended to be used with metallic, or other pens of a like form, and one of its distinguishing fea-

tures is, that it is itself constructed of metal; it is perfectly elastic, yielding along its whole length to the action of the hand, as readily as a quill, and even more so, if desired, whilst it may be made lighter than such as have been heretofore made of whalebone, or other elastic material. Another distinguishing feature is the manner in which I sometimes form the lower end of said holder, as that it will adapt itself to steel, or other pens, varying from each other in width."

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the forming of an elastic, metallic, hollow stem, or handle, by winding a strip of metal spirally, so that it shall constitute a hollow, taper, or cylindrical tube. I also claim the manner of adapting said holder to the receiving, and retaining of pens, varying in width, by making a slit, or slits, in the end, or ferrule formed piece of metal, which is to retain the pen as set forth."

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2. For an *Improvement in the Kiln for Drying Grain;* Henry Y., and Abraham Houpt, Springfield, Bucks county, Pennsylvania, December 5.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is passing the grain between two vertical cylinders, placed over a furnace, heated air being made to pass through the inner cylinder, and in a space between the second cylinder and a casing outside of it, as described."

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3. For an *Improvement in Tanning Leather by Machinery;* David H. Mason, Dahlonega, Lumpkin county, Georgia, December 5.

Claim.—"What I claim as my invention, and desire to secure by letters patent, consists, first, in the employment of a mill, whether made like the swinging stocks, or in any other form in which its action upon the skins is substantially the same, for the purpose of tanning, or otherwise operating upon skins, in the process of tanning; and, second, the forcibly working hides, or skins, in the mill denominated the swinging stocks, or other suitable machine, with tanning liquor, or working them partly in the mill with salts, and partly with tanning liquor."

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4. For an *Improvement in the Combination Tumbler Door Lock;* Robert M. Tuttle, Newark, New Jersey, December 5.

Claim.—"What I claim, is the combination of the protector, or protecting lever, with the wheels, to produce a security unattained, as I think, by other locks: that is to say, I claim to have invented that combined action of the wheels upon the protector, which, by a nice adjustment of the tumblers, allows the bolt to pass out and in, only when the tumblers are elevated by the unequal bits of the key, so as to relieve the bolt from resistance at the slot, and, at the same time, from the hold of the protecting guard."

5. For an *Improvement in Making Black Ink;* Peter Ferris, Greenwich, Fairfield county, Connecticut, December 5.

The patentee says,—"Into an iron vessel put twelve gallons of soft water, and six pounds of ground logwood, and boil it not less than three hours; strain the liquid through a fine wire sieve, or pour it off the sediment, and add the following thereto:—10 lbs. nutgalls, 3 lbs. copperas, 6 oz. blue vitriol, 4 lbs. gum arabic, 1 lb. loaf sugar, 1 lb. Prussian blue, and 1 lb. indigo. Boil these parts together five hours, and let it stand on the sediment 10 or 15 days, stirring it daily; then strain, or settle, the sediment from the liquid; if there be less than nine gallons, add water to make nine gallons, and add thereto one gallon of alcohol, 80 per cent. above proof, and stir it daily for 10 days, and let it settle for three days, and bottle for use."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the compounding the within named ingredients as described, for manufacturing ink."

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6. For an *Improvement in Steam Boilers;* A. W. Sharp and W. F. Horton, Honeoye Falls, Monroe County, New York, December 5.

The patentees say,—"The nature of our invention consists in so constructing the boiler, that the entire chamber and ash pit are surrounded with water, (excepting an opening for the door, and for the smoke pipe, and another small one in the end of the ash pit,) and in placing tubes within the fire chamber."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination and arrangement of the several parts, as set forth, constructed as described: that is to say, of the boiler, constructed of double plates, and double heads, parallel to each other, so that the fire chamber, and ash pit, in combination with the hollow grate bars, and tubes, arranged as set forth, are surrounded with water."

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7. For an *Improvement in Steam Engines;* Alexander Connison, Great Britain, December 5.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining the two pistons, and the cylinder, with a three throw crank, the acting pistons of which are at a distance of 120 degrees apart, in such manner, as that the two pistons, and the cylinder, shall be made to vibrate to equal distances, and so as to allow of the introduction of steam into three compartments, or chambers, within the cylinder, to operate therein, for the purpose, and in the manner set forth.

"I also claim, as a modification of this plan, the causing of the piston heads to vibrate within a stationary cylinder, said heads being fitted to a cylinder in the manner of pistons, and their vibrations being simultaneous;—such heads traversing without the cylinder, in the same manner in which they would traverse with it, under the first described modification, and effecting the same purpose as the vibration of the

heads with the cylinder, and by means substantially the same;—these being, in either case, three distinct motions, namely, that of the two cylinder heads, and those of the two pistons, produced by a three throw crank, constructed and proportioned as set forth.

"I claim, also, the manner in which I have combined and arranged the respective parts of my rotary valve, as herein described. I do not claim to be the first inventor of a rotary valve, but I do claim to be the inventor of the combining of the tangent screw, the valve seat, the openings through that seat, and through the valve box, so as to be capable of adjustment, and to cause them to operate as set forth. I claim the manner of causing this valve to revolve, by means of a shackle-bar, held on a stationary joint pin at one end, and embracing a crank pin on the other, by which motion shall be given to the valve shaft.

"I claim the manner of letting the steam on between the two pistons, by means of a device as represented, by which means, the introduction of steam between the two pistons may be continued during the time required for that purpose."

8. For an *Improvement in Lard Lamps;* P. Robinson, Chillicothe, Ohio, December 5.

Claim.—"What I claim as new, and desire to secure by letters patent, is so constructing the burner of the lamp, as to admit of the inserting of a number of small wicks, through a series of openings in the upper side of such burner, and the passing of said wicks, collectively, through a larger hole, adapted thereto, in its lower side; there being also a number of small holes perforated in the lower side of the burner, for the admission of the lard, or other fatty matter, the whole being constructed and operating substantially as set forth."

9. For an *Improvement in Furnaces;* J. Clute and J. Seabury, Albany, New York, December 5.

The patentees say,—"Our improvement consists in the employment of a descending flue, or flues, down which the draught is made to pass, after it leaves the fuel in the chamber of combustion, or that part of the furnace which contains the fuel. In furnaces constructed on our plan, the supply of air is to be given by means of any suitable blowing apparatus, and by the obstructing of the draught, by the descending flues, and the forcing in of air by the blowing apparatus, a degree of pressure is produced in the interior of the furnace, which has been found highly favorable in economizing the heat, which is the more readily communicated to the article to be acted upon."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combining of the descending flues with an artificial blast, in furnaces, as set forth."

10. For an *Improvement in Ships' Windlasses, or Capstans, and Cable Stoppers;* John Grylls, Great Britain, December 12.

Claim.—"I claim, firstly, constructing or making whelps, to be ap-

plied to capstans, windlasses, and other barrels of a like nature, with angular or inclined sides, by means of which the cable is prevented from suddenly surging, or running out, as is the case with the old whelp; and secondly, I claim the manner of constructing cable stoppers, with parallel surfaces, capable of holding on to a considerable length of cable at one time, the same being constructed as set forth."

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11. For an *Improvement in Metallic Pens;* Timothy Alden, Barre, Worcester county, Massachusetts, December 12.

Claim.—"I claim the method of constructing the parts of a metallic pen: that is to say, supporting the movable blades thereof upon pivots, or contrivances of like nature, (which permit said blades to separate from each other, during the process of writing,) in combination with a suitable spring, applied to, and operating upon, the shank of each of the said blades, the whole being arranged and operating substantially as set forth."

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12. For an *Improvement in Mortising and Tenoning Machines;* Warren L. Peters, Frankford, Philadelphia county, Pennsylvania, December 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lever, arm, and spring, as described; also the combination of the springs and screws, with the carriage, for regulating its position as described."

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13. For an *Improvement in Combined Ploughs;* James Parsons, Jr., Dublin, Wayne county, Indiana, December 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the regular turned mould boards and shares, either of cast or wrought iron, with cast or wrought iron, or wooden sheath, or standards, to shafts, for the purpose of ploughing two furrows, turning them inwards or outwards, by transferring the shares alternately, or by transposition from one side to the other, and working them in a separate or connected position; and the application of the gauge rod, for furrowing out ground, and two, or more, right or left hand shares, for ploughing in wheat or oats, in seeding, in the manner described."

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14. For an *Improvement in Surveying Instruments;* B. H. Benton, Middleburg, Loudon county, Virginia, December 12.

The patentee says,—"The instrument consists of a quadrant, with a geometrical table, and graduated arch, and two limbs connected by a joint. One limb is firmly connected with the quadrant, while the other limb is joined to the centre, in such a manner, as that it can move freely round over the quadrant, and remain in any given position, in which situation it can be secured by a screw, underneath which screw is attached to the said movable limb, at such a distance from the centre

of motion, as that it can move freely just under the arch of the quadrant. These limbs are both graduated, or laid off, in ten equal parts, and marked 1, 2, 3, 4, &c , beginning at the centre of motion;—these parts are subdivided into tenths. Each limb is furnished with a pair of sights, similar to those used in ordinary surveying instruments,—which sights are fastened down by screws. On the stationary limb there is a spirit level, and a box containing a magnet needle. This box can be removed at pleasure, and can be connected, by means of screws, to either limb. The instrument, when in use, is placed on a staff, by means of a ball and socket, which socket is attached underneath the quadrant, about equal distance from the centre and the quadrant arch."

Claim.—"What I claim as my improvement, and desire to secure by letters patent, is combining with a quadrant, (or quadrant with a geometrical table,) a movable limb, or index, graduated in the manner set forth."

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15. For an *Improvement in Bedsteads;* Charles W. Curtis, New Haven, Connecticut, December 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of light hoop-metal bands, with metallic frames of flexible bars, suspended by the loops, and supported as set forth."

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16. For an *Improvement in Laying Off Corn Rows, &c.;* Peter Moseley, Yazoo county, Mississippi, December 12.

The patentee says,—"The nature of my invention consists in forming a level, or horizontal plane, by sight, to measure from, by means of a portable plumb staff, with a movable staff, with a movable object suspended on it, to sight to, the plumb staff and movable object operating as a moving gauge, to measure or gauge from the horizontal sight, as a guide."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of laying off rows, for farmers to plant on, say corn, cotton, or any other thing, by the application of a horizontal sight to gauge or measure from."

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17. For an *Improvement in Wigs;* William Dowell, Philadelphia, Pennsylvania, December 12.

The patentee says,—"The wigs which have heretofore been made in one piece, are, under this improvement, made in two pieces, namely: the one consists of the scalp, intended to cover the top of the head, the other of the rim, intended to encircle it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making of the wig in two separate parts, which, when permanently secured behind, allows the scalp to be brought over the rim, in front, two or three inches, where those parts are fastened together, and admits of being extended after shrinking, as set forth."

18. For an *Improvement in Washing Machines;* F. Fentriss, Greensborough, Guilford county, North Carolina, December 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of arranging and combining the paddles with the box, so that said paddles may have their alternate cotemporaneous motion, up and down the sides of the open box, in the manner set forth."

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19. For an *Improvement in Boot Crimps;* Bradford Rowe, Maryland, Otsego county, New York, December 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the pincers with the removable crimp, as constructed and operated in the manner set forth."

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20. For an *Improvement in Door Locks;* John P. Sherwood, Sandy Hill, Washington county, New York, December 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar construction, and double action, (upon an inclined and horizontal track, or way,) of the locking car, as described, and the combination of the locking car, and safety cars, with one another, and with the connecting or vibrating bar and bolt, so as to fasten the bolt securely, and prevent its being picked."

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21. For an *Improvement in Chimney Caps;* Jordan L. Mott, City of New York, December 17.

The patentee says,—"A distinguishing feature of my chimney cap is, that, although consisting of a vertical, surmounted by a horizontal, tube, it is not made to revolve, like the greater number of instruments for the same purpose, but is fixed permanently on the top of a chimney, or flue. Its vertical tube must be of such size, as shall adapt it to the chimney, or flue, upon which it is to be placed; and this vertical tube opens into a horizontal tube, that is open at both its ends. The horizontal tube I usually form of two conical frustrums, of equal length, united together at their smaller ends, where their diameter should be about equal to that of the vertical tube which enters them, and the whole length of said horizontal tube, may be equal to about three times the diameter of the vertical tube. I sometimes make the horizontal tube cylindrical at its middle portion, where the vertical tube enters it, and attach a conical frustrum at each end of said cylindrical part."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the forming of the horizontal tube, which is open at both ends, of two hollow, conical frustrums, which are to be united together at their smaller ends; or of two such conical frustrums, connected together by an intermediate cylindrical tube, at, or near, its middle, and the instrument, when thus formed, being permanently fixed upon the chimney, or flue, through which an upward draught is to be produced, the whole being combined, arranged, and operating, as set forth."

22. For an *Improvement in Chimney Caps;* Jordan L. Mott, assignee of Thomas Ewbank, City of New York, December 17.

The patentee says,—"My ventilator, or chimney cap, consists of a vertical tube, which is to be placed upon the top of the flue, or chimney, in the ordinary manner, and this vertical tube is surmounted by a tube, placed horizontally upon it, and into which it opens; this horizontal tube is open at both ends, and is so combined with the vertical tube, as to revolve upon it, and thereby enable it to take the direction of the wind, as is usually the case. My improvement consists in the manner in which I form this horizontal tube, by which the action of the wind upon it, in producing an upward draught in the flue, or chimney, is rendered much more effective, than in the ventilators hitherto known and used. This horizontal tube consists of a conical frustrum, which is so placed upon the vertical tube, as that its larger end shall be at a considerably greater distance from it, than the smaller end."

Claim.—"What I claim as new, and desire to secure by letters patent, is the giving of a conical form to the horizontal tube, from one end thereof to the other, or through the greater part of its length, the longer end of said conical tube extending to a distance beyond the vertical tube, much greater than that of the shorter end. I also claim the combining of the conical, or flaring, rim, with the horizontal tube of my ventilator, constructed as described. And I likewise claim the combining of a projecting piece of sheet metal, with such horizontal tube, at the rear of the opening of the vertical flue, the whole being formed and arranged as set forth."

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23. For an *Improvement in Machinery for Breaking Flax and Hemp;* J. P. Fry, Pulaski, Giles county, Tennessee, December 21.

Claim.—"What I claim as my improvement, and desire to secure by letters patent, is sloping the swords, or blades, on their upper edges, from the middle thereof, to their outer or smaller extremities, in the manner set forth."

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24. For an *Improvement in Bee Hives;* William Bryant, Nashville, Tennessee, December 21.

The patentee says,—"The nature of my invention consists in compelling the bees to exclude themselves from that part of their honey which it is desired to take from them, by placing a gate, (which, with the wood in which it is fixed, I call the bee trap,) across their passage, which gate they can pass in leaving their honey, but cannot repass it to return to their honey."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is affixing the bee trap across the bee passage, in that manner, that the teeth of the gate can rise, or open, only outwards from the hive, and permit the bees to exclude themselves from their honey."

25. For an *Improvement in Fastening Door Locks and Latch Knobs to their Spindles, &c.;* Andrew O. Downer, Utica, New York, December 21.

The patentee says,—"The nature of my invention consists in the contrivance of a new mode of fastening, and holding, the knobs to the door, and still allowing them to be turned easily with the hand, to lift the latch."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of fastening knobs to the door, by the use of plates, and their connexion with the knobs and spindle, by which the article is made capable of being readily adjusted to any thickness of the door, and then secured in a simple and substantial manner."

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26. For an *Improvement in Filters;* Thomas Bishop, Dobbs' Ferry, West Chester county, New York, December 31.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the tube to a filter, in an air-tight cask, or other vessel, to equalize the exhaustion or pressure of air, in the two chambers made by the filter, that water may be filtered by its own weight, without being obstructed by the air in the lower chamber, and enabling the pump, or cock, by one operation, to draw filtered water, and to supply the filter anew, with water to be filtered, without disturbing the operation of the filter."

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27. For an *Improvement in Lamps;* W. F. Shaw, Boston, Massachusetts, December 31.

Claim.—"What I claim, is the arranging the solar cone, and ducts, for the outer current of air, upon a tube, or other contrivance of like nature, which may be slipped over the outer tube of the burner of the lamp, and which may be removed therefrom at pleasure, to admit of a substitution of the ordinary apparatus by which the chimney is supported, and by the aid of which, the wick is elevated or depressed, the whole being arranged and operating as set forth. Also the combination, with the cone, or cone plate, of a circular plate, applied to the tube a short distance below the cone plate, in order that the current of air, which is supplied to the outside of the flame, may be introduced into the solar cone in a thin sheet, and be protected, by said plate, from the action of other atmospheric currents, which would be likely to affect the operation of the said external current upon the flame; the whole being arranged as described."

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28. For an *Improvement in Copying Machines;* L. Carpenter, Oswego county, New York, December 31.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the construction and combination of the two groove bars, so as to constitute two combined and variable axes of motion to the compensating lever. 2d, The combination and adjustment of the

square and oblong, with the two groove bars, so as to impart the motion of the lower end of the compensating lever to the square."

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29. For an *Improvement in Pumps;* William and Benjamin Douglass, Middletown, Middlesex county, Connecticut, December 31.

The patentees say,—"The nature of our invention consists in constructing a pump in such a manner, that it may be conveniently adapted to any part of a dwelling, or other place, where the room is cramped; also so that the lower box, or valve, may be got at with much less difficulty, than in the old and ordinary way; and in having the stand, to which the brake is attached, permanently secured by set screws, uniting with a stirrup beneath a projection in the cylinder, and also the manner of securing the lower valve in its place."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the revolving stand to which the brake is attached, and the mode of securing the lower valve in its place."

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30. For an *Improvement in the Rotary Steam Engine;* Wm. Jones and Roswell Farnum, Bradford, Orange county, Vermont, December 31.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the revolving circular valve, or hub, constructed with the slot on one side, grooved or channelled on the other, and an aperture passing through it, placed in a grooved or circular recess, in the bottom of the cylinder; and operated by the piston, by the means described; the whole being constructed, and operating, substantially as described;—in combination therewith, the arrangement of the condenser as set forth."

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31. For an *Improvement in Ditching and Embanking Earth;* Horace Cleveland, Fort Wayne, Whitley county, Indiana, December 31.

The patentee says,—"My ditching machine is in the general form of a double mould board plough, the respective parts of which are attached to a beam furnished with a clevis, by which it is to be drawn forward. In front of the share and mould board, it is furnished with three cutters, which are made fast at their upper ends to the beam, and to cross-trees attached to the beam, for the purpose of holding them. One of these cutters is in a line with the middle of the beam, and descends down to the level of the double share, and the sole of the plough, and is, at its lower end, nearly in contact with the point of said share. The other two cutters are designed to cut the two sides of the ditch, and are so placed, as to give to those sides the proper inclination, or slope, from top to bottom; their lower edges terminate on each side of the double share, near to the rear ends or angles of its cutting edges. The earth, after being divided by these cutters, is elevated by what I denominate the lifters, which rise in the manner of inclined planes, and extend along the lower edges of each of the mould boards,

their rear ends being at such height, as to be above the surface of the ground upon which the excavated earth is to be thrown. The rear and lower edges of the mould boards rise upwards, so as to coincide with the upper sides of the lifters, and, by the concurrent action of the two, the earth is thrown out of the ditch, and two embankments are formed, one on each side of it."

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have combined the lifters and the mould boards, with the double share, and middle and side cutters, so as to constitute a machine for ditching and embanking, arranged and operating substantially as set forth."

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32. For an *Improvement in Water Wheels;* S. L. Valentine, Bangor, Maine, December 31.

The patentee says,—"My improvement is in that variety of wheels commonly called re-acting wheels, and consists in my peculiar manner of constructing the wheel, and buckets attached to the same, to allow of the wheel being cast in one piece, without any injury resulting from the contraction of the metal, in cooling, and also to produce a better effect."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the concavo-convex construction of the wheel, being convex on one side, and concave on the other side, from the periphery to the shaft, in combination with the buckets and rim, constructed and arranged as set forth."

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33. For an *Improvement in Sounding Instruments;* Henry S. Stellwagen, Philadelphia, Pennsylvania, December 31.

The patentee says,—"Operation.—As the weight descends, the resistance of the water will cause the valve to rise on the cylindrical part of the stem, and rest against the under side of the large end of the weight, and the valve to fall upward. When at the bottom, the cup enters the sand, or mud, and is filled. It is then drawn up, and, in ascending, the motions of the aforesaid valves will be reversed by the resistance of the water—the valve spreading over the mouth of the cup, and a valve descending upon it, to hold it firmly down upon the edge of the cup."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described apparatus, for bringing up specimens of the bottom, at sea, for the uses of marine surveying, and navigation generally."

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34. For an *Improvement in Inclined Water Wheels;* John T. Gilmore, Fayetteville, Cumberland county, North Carolina, December 31.

Claim.—"This wheel combines two principles—percussion and gravity; the latter is in constant operation, so long as the water remains in the bucket, during the revolution of the wheel. This is so, because the wheel is made to run slower than the water would descend on a

smooth surface, having the same inclination as the wheel. I do not claim to be the inventor of the inclined wheel; but I do claim the invention of the inclined water wheel, with buckets as described, in such a manner as to combine percussion and gravity, as set forth. I therefore desire to secure by letters patent, only the inclined water wheel, constructed with buckets, as described, to be applied to any machinery propelled by water power."

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines. By M. V. Regnault.

EIGHTH MEMOIR.

On the Elastic Force of Steam at Different Temperatures.

(Continued from page 335.)

After briefly citing the principal authors of experiments upon this subject, (among which the Committees of the French Academy of Sciences, and of the Franklin Institute, are particularly referred to,) M. Regnault remarks, that further researches are rendered necessary by the disaccordance among former results. The fact also shewn by him in a previous memoir, that mercurial thermometers could not be relied upon at temperatures above those of the fixed points by which their scales were graduated, indicates the necessity of repeating the observations, with attention to the proper corrections for this source of error.

The memoir is divided into three parts. The first part includes the experiments upon the elastic force of the vapor of water, at low temperatures: that is, from —32° to +50° (—25°·6 to +122° Fahr). The second includes the experiments made between 50° and 230° (122° to 446°). Finally, in the third part, the graphic representation of the experiments is studied, and the formulæ of interpolation which represent them sought.

First Part.—*Of the Elastic Force of the Vapor of Water at Low Temperatures.*

M. Regnault remarks that, to establish any physical datum with precision, it is not sufficient to examine it by a single method of experimentation. If the results disagree with those already admitted in the science, it will be most frequently difficult to decide which ought to be preferred; there will be nothing to guide us in our choice, except the more or less favorable opinion which we may entertain of the process employed, or the greater or less confidence which we have in the skill of the experimenter. To remove all doubts, it is necessary to make the experiments by various processes, and to employ even the same processes which were used by preceding investigators, except

where these are absolutely defective. We must shew that all these processes, when properly conducted, lead to the same results; or, if they do not, shew by direct experiment, the causes of error. This method is long and troublesome, but it is the only one likely to introduce into physical science, accurate numerical data.

I. Almost all the experiments upon the elastic force of the vapor of water at low temperatures, have been made by two barometers, dipping into the same cistern of mercury;—into one of the barometers a small quantity of water is introduced, which rises into the vacuum. The difference of height of the mercury in the two tubes, which are, in other respects, under identical circumstances, marks the tension of the vapor at the existing temperature. The difficulty of determining this temperature exactly, constitutes the greatest uncertainty in this method of operating. Most philosophers, who have employed this method within the limits of atmospheric temperatures, have contented themselves with placing a mercurial thermometer alongside of the tubes, at the height of the chamber, whose indications were regarded as giving the temperatures to which the tension corresponds. M. Kœmtz has made, in this way, a long series of observations, during two entire years, and thus obtained the elastic force of watery vapor, from —19° to +26° (—2°·2 to +78°·8 Fahr).

The same processes have been employed by various philosophers, for temperatures above those of the atmosphere. In this case, the barometers were placed in a glass envelope filled with water, the temperatures of which were successively raised. Dalton placed only the wet barometer in a second larger glass tube, closed below with a cork, through which the barometer tube passed;—he filled the interval between the two tubes with water, brought successively to different temperatures.

This method is not susceptible of great precision, for it is impossible to keep a column of liquid, of any height, at a uniform temperature, without continually agitating the liquid, and in Dalton's experiments, there was no method of rendering the temperature stationary, for a time sufficiently long for the column of mercury to place itself in equilibrium of temperature with the surrounding air.

M. Regnault made a series of observations in this manner, in which every precaution was used to avoid sources of error. The envelope was 23 centim. (9 in.) in diameter, provided with an agitator, and the temperature was measured by a mercurial thermometer, immersed in the water at the height of the columns of mercury. When the proper corrections were made, the results given by this apparatus were identical with others, got by a method afterwards described, and are, therefore, not reported.

M. Regnault remarks that this method furnishes very accurate results, for temperatures equal to, or a little above, the surrounding temperature; but ceases to be rigorous for temperatures somewhat higher: the uncertainty arising from the rapid division of the column of liquid, into strata of different temperatures, as soon as the observer ceases to stir it, for the purpose of reading the height of the mercury. Another

series of experiments was made with two barometers, one dry, the other wet, not heating the whole column, but only the upper portions.

Experiments can be made in this way with great precision, at the surrounding temperature, and may be repeated as often as is desirable. With a little practice, it is also easy to keep the small column of water of uniform heat, at higher temperatures. Three or four observations were made at the same temperature, leaving an interval of eight or ten minutes between every two consecutive observations. Sometimes the temperature of the bath was intentionally suffered to rise, or to fall, in the interval between two observations, and then again rendered stationary, by regulating the lamp by which it was heated. It was thus easily seen, that the movements of the mercurial column followed the slightest variations of the thermometer, and identically the same tensions were found, whenever the thermometer indicated the same temperature.

Direct experiments shewed that the part of the mercurial column immersed in the bath, had precisely the same temperature as the water, although it was lying upon a colder column, and that the conditions of the two columns were identical, with the exception of the introduction of the water into one.

The results were reduced to 0°, and corrected for the small column of water in the wet barometer, and for the effect of the capillary attraction of the water, and the results given in tabulated form.

II. The second series of experiments was tried with the following apparatus: A glass globe, of about 500 cubic centim. (30 cu. in.) incloses a small glass bubble, filled with recently boiled water. The globe is welded to a bent tube, which is cemented into a copper tube with three branches, into one of which is cemented another glass tube, welded into the top of a tube similar to a barometer tube. The third branch of the copper tube communicates, by means of a glass tube, 1 metre in length, filled with pumice stone, soaked in sulphuric acid, with an air pump. The barometer tube is arranged vertically, alongside of a true barometer, their upper parts passing into a sheet-iron trough, in which the glass globe is also placed.

The apparatus being thus arranged, a vacuum is made a great number of times, and after each time, the air is suffered to enter slowly through the drying tube. After this has been done forty or fifty times, the globe and barometer tube may be considered perfectly dry; a vacuum is then made as perfectly as possible,—the pump used carried it to below 1 mm. (·039 in.)—and the small tube, communicating between the apparatus and the drying tube, closed by the lamp. The globe was then surrounded by ice, and at the end of some time, when the equilibrium of temperature is established, the difference of height of the two mercurial columns is taken by cathetometer; we thus get the elastic force of the air remaining in the globe at 0°. The ice is then removed, and the globe heated gently, at the place where the bubble rests, until this is broken by the expansion of the liquid within it; the ice is then restored, and after the temperature of 0° has been established, a new observation is taken of the difference of heights of the columns in the two barometers. The first difference subtracted

from this, gives the tension of the vapor at 0°. In order to get the tensions at their higher temperatures, the ice is replaced by clear water, which may be heated to the proper temperatures, and the observations are made as before. In order to obtain these measurements, a pane of well selected glass is inserted in one side of the trough, opposite to the barometer tubes. Proper care was taken to avoid error, by the displacement of the marks observed by the refractions of the water and glass.

The barometer used in these experiments was carefully compared with a standard. It was also shewn to be free from air, by an other method of verification, which consists in raising or lowering, as far as possible, the level of the mercury in the cistern; if the vacuum be perfect, the height of the mercurial column above the level of the cistern, will remain always the same, but this will not be the case, if the space above the mercury contains air. This method of verification was long since suggested by M. Arago. The same apparatus is very suitable for observations in the tension of the vapor, at temperatures lower than 0°. For this purpose, a glass jar is substituted for the sheet-iron trough, and a saturated solution of chloride of calcium for the water. The temperature of the solution is reduced, by the addition of ice, or it may be raised, if necessary, by adding a portion of the solution heated. This is used in place of water, to avoid reducing the frigorific power of the solution, in case it is desirable to lower the temperature again. It is evident that the nearer the temperature approaches that of the surrounding air, the more easily it is kept stationary; in this case, too, the variation of the elastic force with the temperature is most sensible. Below —20° (—4° F.) a change of some tenths of a degree in the temperature, produces but insensible variations in the elastic force of the vapor of water. This apparatus may also serve for experiments, at temperatures somewhat higher than that of the surrounding air; but if the temperature be raised more than 10° or 15° (18° or 20° F.) above this, the water of the globe distils, and condenses in the tubes, and the observations become uncertain. A simple modification of this apparatus, will serve to determine the tension of aqueous vapor in air more or less rarefied, in order to determine whether this is the same as in vacuo. The experiments on this subject have already been published in M. Regnault's memoir on Hygrometers. (*Annales de Chimie et Physique, 3e serie, tome* xv, *p.* 130.)

It is absolutely necessary to dry the globe thoroughly before breaking the bubble. To ascertain whether this was done in the method just related, the apparatus was modified by inclosing the bubble in a separate tube, so as to allow the globe to be heated while under repeated exhaustions by the air pump. The value thus obtained, for the elastic force of the vapor at 0°, is rather less than that obtained by the other method.

Finally, this apparatus was also used to determine the tension of the aqueous vapor in an absolute vacuum. For this purpose, the water was at once placed in the globe. The apparatus being arranged as usual, a vacuum is made by the air pump, and the globe gently warmed, when some water distils over, and condenses in the barometric

tube. By continuing the exhaustion, a continual distillation of the water is produced from the globe and the tube, which water condenses in the drying tube. After distilling, in this way, several grammes of water under a very feeble pressure, it may be admitted that the air is completely expelled from the apparatus. The tube communicating with the air pump is then hermetically sealed, and the observations made as usual.

III. M. Regnault describes another form of apparatus, applied by him for the determination of the elastic forces of the vapors of very volatile liquids; but as it has never been used by him for the vapor of water, and is not regarded by him as capable of giving results as accurate as the others, we omit its description.

IV. *Of the Tension of the Vapor of Mercury.*

In the most of the preceding experiments, the column of mercury which transmits the pressure, is heated to the same temperature as the vapor whose tension we are measuring, and sometimes the space in which the vapor is developed, is in easy communication with the tube holding the mercury. Now if, within the limits of temperature at which we operate, the tension of the vapor of mercury was notable, this tension might have been added to that of the liquid under examination, and thus have rendered our determinations inaccurate.

Two series of experiments made by the apparatus which we have described, mercury being substituted for water,—in one of which series a notable quantity of air had been left in the apparatus, while in the other, the vacuum was made as perfect as possible,—gave results so discordant, as to be worthless as measurements of the relative tensions of mercurial vapor at low temperatures. The differences, however, though relatively great, are actually within the limits of errors of observation, and they suffice to shew that the tension of the vapor of mercury, at 100°, (212° F.,) is about 0·5 mm.; (0·02 in.;) and that at 50°, (122° F.) it scarcely reaches 0·1 mm. (0·004 in.)

Below 50° it is almost negligable, and M. Regnault did not judge it necessary to introduce this correction into the tables, because it is not sufficiently certain, and is of the same order as the errors of observation.

Part Second.—*Of the Elastic Force of the Vapor of Water at High Temperatures.*

The methods explained in the preceding part of this memoir, are suitable only for temperatures below 60° or 70°. (140° or 158° F.) At higher temperatures, the water divides itself into layers of unequal heat, so that a continual agitation is necessary to prevent this separation. These methods, moreover, become altogether impracticable at temperatures above 100°. (212° F.) For higher temperatures, therefore, M. Regnault had recourse to a method long known, and employed by several experimenters, especially by MM. Arago and Dulong: that is, observing the temperature at which the water boils, under given pressures. It presents the advantage of being applicable to the heaviest pressures, and it gives very exact results when it is properly applied.

In the apparatus of MM. Arago and Dulong, (*Ann. de Chim. et de Phys.*, *2e serie*, *tome* xliii, *p.* 74,) the water did not actually boil; its elastic force increased, by the heat, up to a certain maximum, which was measured on a manometer, (air pressure-gauge,) at the same time that the thermometers immersed in the water and steam were observed. At other times, the manometer and thermometers were simultaneously observed, while the temperature was still rising, and had approached a maximum. It is to be feared, in this way of observing, that the thermometers, which are necessarily a little behind the temperature of the steam, have not attained the same temperature with it, at the time that they mark their maximum. The error which could arise hence, is probably very small, or even insensible, in experiments made at very high pressures, because, in this case, a very small difference of temperature corresponds to a great change of elastic force; but the error will probably not be negligable under light pressures, as, for example, under such as are less than that of the atmosphere.

It is easy to avoid all objections of this kind, in this process, by arranging the experiment under conditions identical with those under which water is boiled, under the ordinary pressure of the atmosphere, for the purpose of determining the fixed point, 100° of the thermometric scale; and the temperature at which water boils, under different pressures, may then be determined with the same precision. For this purpose, it suffices to cause the water to boil, in a vessel communicating freely with a somewhat large space, in which the air may be compressed or dilated at will;—this air forms an artificial atmosphere, exercising a pressure on the surface of the heated liquid. A temperature of ebullition may be thus obtained, as perfectly stationary as that which water presents, when it boils in the open air; and this temperature may be kept stationary as long as we please.

But before arranging the apparatus by which the experiments might be tried under heavy pressures, and which must necessarily be expensive, M. Regnault thought proper to try the process upon a smaller scale, so as to study the various circumstances, and detect the causes of error which presented themselves.

This apparatus consisted of a copper alembic, with a cover of the same bolted to it, through which cover passed four iron tubes, nearly filled with mercury, for the purpose of holding the thermometers.—Two of these tubes passed nearly to the bottom of the alembic, so that the thermometers contained in them, were below the water level; and the other two reached to such a depth only, that their thermometers indicated the temperature of the steam. The neck of the alembic opened into a tube a metre in length, surrounded by another much larger tube, through which a constant current of cool water was kept, for the purpose of condensing the steam. This condensing apparatus opened into a copper globe of 24 litres (6⅓ galls.) capacity, which could be connected, by one adjutage, either with the barometer apparatus, used in the previously described experiments, or with the open air manometer, described in a former memoir; and by another adjutage, with an exhausting or condensing pump, at pleasure. It is not necessary that we should copy the detailed account of the method of experimen-

tation with this apparatus. Care is, however, necessary in determining the position of the meniscus which oscillates in this apparatus; with attention, however, a point of time can be easily found, when it remains stationary, and the oscillation never exceeds 0·1 mm. (0·0039 in.) The thermometers were read by telescope, at a distance, for the purpose of avoiding the effects of parallax.

The thermometers used in this apparatus were mercurial, with the common straight stems; a part of the column of mercury necessarily rose above the cover of the alembic, and was, of course, not at the same temperature as the steam, and consequently required correction. This correction would be easy, if we knew the mean temperature of this column with sufficient precision. When the stem is in the open air, the different points of the column, above the steam, are at different temperatures, according as their distances from the cover are greater or less. Disapproving, for reasons which he assigns, of the mode by which MM. Arago and Dulong sought to remedy this evil, M. Regnault made use of the common straight stem thermometer, so adjusted that but a small portion of the tube should rise above the cover of the alembic, and admitted this small column to have a mean temperature, equal to that which was indicated by a small thermometer placed opposite the middle of the projecting column. That this correction was sufficiently exact, he satisfied himself by the following experiments.

A very accurate thermometer, perfectly free from air, and having a range from 0° to 100°, had, at the upper extremity of its tube, an enlargement of the bore, into which a portion of its mercury could be discharged. The 0° of this thermometer was taken with the greatest care in melting ice, and 100° in boiling water, the whole stem being immersed in the vapor. This thermometer was immediately placed in one of the tubes of the alembic, in which water was boiling under the atmospheric pressure; a portion of its tube projected from the cover. The temperature indicated by the thermometer was corrected for the portion of the stem not immersed, by supposing the temperature of this part the same as that indicated by a small thermometer, whose reservoir was placed at its middle. This temperature, thus corrected, was found identical with that which had before been obtained, when the whole stem was immersed in the steam. But this experiment was not sufficient to establish the accuracy of the correction, since we must still assume that the thermometer immersed in the mercury, in the tube, indicated exactly the temperature of the steam. This was shewn to be the fact by direct experiment. A little of the mercury was discharged into the upper pouch of the instrument, so that, when the thermometer was again immersed in the tube, the water boiling in free communication with the air, the mercury rose only a few millimetres above the cover. The division reached by the mercury, was marked with the greatest care by the telescope of the cathetometer, and the instrument was then placed in the apparatus, for determining the fixed point 100°. It was impossible to detect the least difference between the points to which the mercury rose in these two cases, although a centigrade degree occupied six divisions of the scale.

To determine the correction for the unimmersed part of the stems,

at high temperatures, the comparison was made between their indications, and those of an overflow thermometer, which was completely immersed. These experiments were made at temperatures of 120°, 130°, and 140°, and it was found that, within these limits, the corrections made by assuming the mean temperature of the emerging column, as that indicated by a thermometer placed at its middle, were sufficiently accurate.

The thermometers employed in the experiments at pressures below the atmosphere, were graduated from 0° to 100°. They had six or eight divisions to a degree, and it was consequently easy to read, with certainty, to $\frac{1}{60}$ of a degree, ($\frac{1}{33}$° F.) The four thermometers used for higher pressures, were graduated from 0° to 240°. The degree centigrade corresponded to from 2·5 to 3 divisions of the scale. All these instruments were graduated and verified by M. Regnault himself, with the greatest care.

In the tables of the experiments, the temperatures of the thermometers immersed in the water, are given separately from those in the steam. In the boiling of water at low pressures, the thermometer plunged in the water, marks a temperature notably higher than that in the steam. This difference, which amounts to 0·7°, (1·12° F.) under very low pressures, gradually diminishes as the boiling point rises, until at the boiling point under atmospheric pressure, it becomes insensible.

The experiments made in this way at low pressures, present as perfect a concordance as could be desired, with those by the previously described methods, which, however, M. Regnault thinks are preferable for low temperatures.

M. Regnault also presents several tables of results, obtained by various experimental philosophers, on the boiling point, and corresponding barometric pressure at various points, of different heights, upon the surface of the globe. The difference between their observed results, and those calculated from the formulæ founded on M. Regnault's experiments, rarely amounts to $\frac{1}{700}$. The greatest amounts to $\frac{25}{6770}$ of the pressure, and corresponds to a difference of 0·1° Cent. (0 18° F.)

Experiments with the large Apparatus.

The preceding experiments having convinced M. Regnault of the accuracy and perfect regularity of the process just described, he determined to construct the principal apparatus upon the same principles. This apparatus, intended for the study of the elastic forces of steam at high temperatures, is composed, 1st, of a boiler; 2d, of a condenser; 3d, of an artificial atmosphere; 4th, of a mercurial manometer; 5th, of a forcing pump.

1st. The boiler was of copper, 5 mm. (0·2 in.) thick; the joints rivetted and brazed. Its height 0·8 m., (2·63 ft.,) its diameter 0·35 m.; (13·783 in.;) its total capacity about 70 litres. (18·5 galls.) Its copper cover was 12 mm. (0·46 in.) thick, and was fitted to the cylinder with a red-lead joint, and secured by screw-bolts. This cover carried three copper tubes, closed below, screwed and brazed into it, and passing into the boiler. Two of these tubes, each 10 mm. (0·4 in.) in interior

diameter, and 1 mm. (0·04 in.) thick, were intended to hold mercurial thermometers; one of these descended nearly to the bottom of the boiler, and is intended to indicate the temperature of the water; the other did not reach the water-line, and is intended to give that of the steam. The third tube, 32 mm. (1·26 in.) in interior diameter, and 1·5 mm. (0·06 in.) thickness, was to hold the air thermometer, and did not reach the water level. The thermometers in these tubes were immersed in linseed oil. The boiler was placed on a sheet-iron furnace, provided with a long chimney, and the registers necessary for regulating the draught. It was strengthened externally, by iron bands.

2d. The refrigerator was made of a copper tube, 30 mm. (1·18 in.) in diameter, fixed to the neck of the boiler by a red-lead joint. This tube, for a length of 1·6 metre, (5·33 ft.) was surrounded by a much larger pipe, through which a current of cool water was made to circulate.

3d. The air reservoir was formed by a copper cylinder, 2 metres (6·56 ft.) high, and 0·42 metres (16·6 in.) in diameter;—its cubic capacity was, consequently, 280 litres. (73·892 galls.) Its walls were 13 mm. (1·536 in.) thick; the joints were rivetted while hot, and then soldered, so as to close them absolutely hermetically. This cylinder was fixed at a proper height, by strong iron collars, firmly fixed in the wall. It carried a bronze adjutage at each extremity, by the lower one of which it was put in communication with the condenser, and, consequently, with the boiler. The connexion was made by a red-lead joint. The upper adjutage put the reservoir in communication, on the one hand, with the condensing pump, and on the other, with the manometer.

4th. The manometer, intended to measure the pressure in the reservoir, and, consequently, that in the boiler, is the open mercurial manometer, described in the Sixth Memoir. (See p. 193.) This manometer is far preferable to those constructed with compressed air, which are ordinarily employed. These latter assume the absolute accuracy of the law of Mariotte at high pressures, and present the very great inconvenience of being less sensitive, in proportion as the pressures to be measured are greater. But the open manometer can only be employed in apparatus where the pressure can be regulated at will, and then kept constant for an indefinite period; which condition is not realized in any of the apparatus which have hitherto been contrived for the purpose of studying steam of high pressure.

5th. The air pump consisted of three single-acting cylinders, of 5 centim. (1·969 in.) interior diameter, and 14 centim. (5·5 in.) stroke; thus the volume of air driven out at each stroke, is 275 centim. cube, (16·78 cu. in.) The piston rods work in guides, and are worked by cranks, from a horizontal axis, provided with a winch at each end.—When the air condensed in the reservoir, does not exceed a pressure of 10 atmospheres, two men at the winches are sufficient to work the pump; but at a pressure of 20 atmospheres, four men are necessary.

The mercurial thermometers used were those formerly experimented with, and shewn to accord accurately throughout their whole scales. The mercury in their stems, never rose more than 1 or 2 centim. above

the cover, and therefore needed no correction. But it was found that, when the temperature exceeded 180°, (324° F.,) it was necessary to allow the column to rise a little more, say 3 centim., (1·18 in.,) in consequence of the mercury distilling and re-condensing in the upper part of the tube.

The air thermometer was similar to those before described.

After this detailed description of the parts of the apparatus, it will be easy to understand the general method of observing.

The water in the boiler being brought nearly to the boiling point, the air is compressed in the reservoir, so as to obtain nearly the pressure under which the observation is to be made. The mercury is then properly adjusted in the manometer, by compressing the air in the cistern with which it is connected, and when the column has risen to the proper height, by turning a stop-cock, all connexion between the tube and cistern is cut off, and then, by another stop-cock, the pressure upon the cistern is discharged. During this time, the water in the boiler has reached the boiling point;—the ebullition is kept up for at least half an hour, and the observations are not commenced until the mercurial thermometers, in the boiler, are absolutely stationary. The mercury in the gauge of the air thermometer, is then brought to the mark traced upon its tube.

One observer records the mercurial thermometers of the boiler, and makes the observations necessary for the calculation of the air thermometer. Two others simultaneously read the levels of the mercury in the two branches of the manometer, by means of two cathetometers, and then observe the thermometers placed along the column. It is important that these levels should be noted at the same moment; it is, therefore, done by a signal given by one of the observers, at a moment when the oscillations of the column are insensible.

When the pressure upon the apparatus does not exceed 5 or 6 atmospheres, these oscillations are scarcely perceptible, even in the telescopes of the cathetometers, which magnify highly, and the columns of mercury sometimes remain completely at rest, for more than a quarter of an hour. The slight variations of elastic force are due only to slight changes of temperature which the reservoir experiences, and might have been completely suppressed, if it could have been placed in a vessel of water. When the pressure surpasses 8 or 10 atmospheres, the oscillations of the columns become more sensible, but they never reach ½ mm. The changes which the elastic force of the air experiences, from variations of the temperature in the reservoir, are greater at high pressures, but whenever these were at all notable, they were observed to be accompanied by corresponding variations in the indications of the thermometers in the boiler.

All experimental philosophers know how difficult it is to retain perfectly, air compressed under heavy pressures, and it was only by infinite care in the adjustment of the various parts of the apparatus, that this condition was satisfied with a perfection that had not been hoped for. It was only after the apparatus had been kept for several days together, with the air compressed under considerable pressures, that a slight leak was sometimes manifested, in some of the joints; but they

were easily stopped, as soon as detected, either by tightening the screws, or by burnishing the parts of the metal around the leak.

Several determinations were made in succession, under the same pressures, leaving an interval of 10 minutes between them. The thermometers in the boiler varied very little during these intervals—rarely did the differences of their indications reach $\frac{1}{10}$th of a degree, and they always corresponded to variations in the pressure. Very often, a small quantity of the air was intentionally discharged from the reservoir, and after 10 minutes, a new determination of the boiling point was made, under a pressure only a few centimetres lighter. It was thus shewn, that the thermometers followed the variations of the pressure with great fidelity. Besides, an idea may be formed of the perfect regularity of the phenomenon, when the apparatus is in good condition, by the last four experiments of the table, which were made under a pressure of 28 atmospheres. These four determinations were obtained 10 minutes apart, so that the last one was 40 minutes after the first, and during this interval of time, the thermometers of the boiler varied only 0·05°, (0·09° F.,) corresponding to a decrease of 17 mm. (0·67 in.) in the manometer.

The pressure of 28 atmospheres was not the highest obtained with this apparatus. A series of experiments at 30 atmospheres was commenced, and the water had been, for more than half an hour, boiling under this enormous pressure, when an accidental blow cracked one of the manometer tubes, at the joint just above the roof of the building: and the boiler having been much strained, and one of the strengthening bands ruptured, it was judged most prudent not to proceed farther with this apparatus. M. Regnault, however, proceeds to describe minutely, another arrangement, by which the experiments might be carried much farther, and which he also proposed to apply to experiments upon the condensation of the gases.

(To be Continued.)

On Hydraulic Pressure Engines.

Read before the British Association for the Advancement of Science.
By Mr. J. Glyn.

Mr. Glyn read a paper, in which he called the attention of the members to a mode of employing the power of waterfalls in a most useful and important manner—too long neglected in this country, considering the advantages it affords in hilly districts, for the drainage of mines. He brought under their notice the means of employing high falls of water, to produce a reciprocating motion, by means of a "pressure engine."

The pressure engine acted by the power of a descending column of water, upon the piston of a cylinder, to give motion to pumps, for raising water to a different level, or to produce a reciprocating motion for other purposes. The pressure engine was calculated to give great mechanical effect, in cases where waterfalls may be found of much too great a height, and too small a quantity, to be practically brought

to bear in a sufficient degree on water wheels within the ordinary limits of diameter.

The author produced instances of the desired pressure engine, one of which was constructed about forty years ago, in Derbyshire—and which he believed was still at work in the Alport Mines, to which it was removed from its original situation. The cylinder was, he believed, 30 inches in diameter. In 1841, Mr. John Taylor advised the application of another and more powerful engine, at the Alport Mines, which was made under his (Mr. Glyn's) direction, at the Batterby Ironworks, in Derbyshire. This was the most powerful engine that had been made. The cylinder was 50 inches in diameter, and the stroke 10 feet. It was worked by a column of water of 132 feet in height, so that the proportion of power to act on it, was as the area of a piston to that of the plunger—namely, 1963 to 1385, or fully 70 per cent. The superintendent of the machinery assured him, that the engine had never cost them £12 a year since it was erected. Its usual speed was about 5 strokes per minute; but it was capable of working at 7 strokes per minute, without any concussion in the descending column, the duty actually done being equal to 163 horse power:—Area of plunge, 9·621 feet $\times$ 10 feet $\times$ 7 strokes $=$ 673·41. 673·41 $\times$ 62·5 $\times$ 132 $= \frac{5555632}{33000} =$ 163 horse power.

The author concluded by remarking that, in this case, as in all others, when water acts by its gravity, or pressure, those machines do the best work, when the water enters the machine without shock, or impulse, and quits it without velocity. They thereby obtain all the available power that the water will yield with the least loss of effect; and this result is best accomplished, by making the pipes and passages of sufficient and ample size, to prevent acceleration of the hydrostatic column.

Lond. Athenæum, Aug. 1848.

On a New Element of Mechanism.

Read before the British Association for the Advancement of Science.

By Mr. R. Roberts.

The writer explained the construction of a contrivance, by which he effected, in a very simple manner, movements for which more complicated mechanism was frequently employed. The model consisted of a steel stock shaft, on which were fitted two brass disks, in such a way as to be kept steady. One of the disks had eleven teeth, rounded at the top and bottom, in its circumference, and was placed on the body of the shaft. The other disk, which was rather the larger, was in the eccentric position of the shaft, with its face to that of the toothed disk. The plain disk had four studs rivetted into it, at equal distances from each other, and at such distances as to admit of their being brought successively, by the revolution of the eccentric, to the bottom of the hollows in the toothed disk. The following movements may be effected by this model: viz., if the shaft be held stationary, and the disks be made to revolve upon it, one of the disks will make twelve revolutions whilst the other only makes eleven. Again, if the toothed disk be held

whilst the shaft be made to revolve twelve times, the plain disk will revolve, in the same direction, one revolution only; and if the plain disk be held, the toothed disk will perform one revolution, in the contrary, for eleven revolutions of the shaft. It would be evident that almost any other number of revolutions may be produced, by employing a smaller number of studs, not fewer than three, which will not divide the number of teeth in that disk. The idea of this novel element in mechanics, was suggested to Mr. Roberts by a dial movement in an American clock. Ibid.

Applications of Gutta Percha.

Read before the British Association for the Advancement of Science. By Mr. F. Whishaw.

Mr. Whishaw read a paper, giving an explanation of the various applications of Gutta Percha; numerous specimens of which, in the shape of thread, cord, tubular staves, driving bands, constables' staves, sticks, whips, inkstands, medallions, shields, water buckets, stereotype plates, and almost every other description of article, both useful and ornamental, were present.

The paper, after stating that gutta percha was the concrete juice of a large tree of the same name, abounding in Borneo, &c., obtained by tapping the tree periodically, by the Malays, stated that its introduction into this country was purely accidental; Dr. Montgomery having transmitted the first sample of it to the Society of Arts, in 1843, at which time he (Mr. Whishaw) was Secretary to that Society. The first articles of use made of gutta percha, in this country, were laid before the Society of Arts in 1844, and consisted of a lathe-band, a short length of pipe, and a bottle-case, which he had himself made by hand, having caused the concrete substance to become sufficiently plastic, by immersing it in hot water. He also produced casts from medals, which attracted considerable attention at the time, and surgical instruments were soon after made of this new material. It was also adapted to commercial uses; and, from the period mentioned, to July 11th, in the present year, between 600 and 700 tons had been imported for the Gutta Percha Company. From 20 to 60 tons were now regularly imported every month.

Contrary to the general opinion, that gutta percha is a simple, hydrogenous substance, Mr. Crane (chemist to the Gutta Percha Company) found it, in its ordinary state, to consist of at least two distinct materials, besides a notable proportion of sulphur—viz., 1. A white matter, gutta percha in its pure state; 2. A substance of a dark brown color. Various experiments were made, to ascertain its strength when mixed with other matters, and also, as to what pigments would mix with it, without rendering it brittle, or deteriorating its qualities.—From these it appeared, that the only pigments that could altogether be relied on, to be used with gutta percha, were orange lead, rose pink, red lead, vermilion, Dutch pink, yellow ochre, and orange chrome.—Under the influence of heat and pressure, gutta percha would spread

to a certain extent, and more so if mixed with foreign matters. All the mixtures, composed of gutta percha and other substances, which had been subjected to experiment, except that containing plumbago, were found to increase its power of conducting heat; but in its pure state, gutta percha was an excellent non-conductor of electricity. The best composition for increasing the pliability of gutta percha, was that formed in conjunction with caoutchouc tar, and next in order, that of its own tar; and the best material at present known, for moulding and embodying, was obtained by mixing gutta percha with its own tar and lamp-black.

In describing the process of manufacturing gutta percha, the author observed, that rude blocks of the material were first cut into slices, by means of a cutting machine, formed of a circular iron plate, of about 5 feet in diameter, in which there are three radical slots, furnished with as many knives, or blades. The blocks are placed in an inclined shoot, so as to present one end to the operation of the cutters. The slices are then placed in a wooden tank, containing hot water, in which they are left to soak, until found in a plastic state. They are afterwards passed through a mincing cylinder, similar to that used in paper mills, for the conversion of rags into pulp, and then thoroughly cleansed in cold water tanks; the water, in cases of impure gutta percha, being mixed with a solution of common soda, or chloride of lime. It is next put into a masticating machine, such as is used in the manufacture of caoutchouc, and then pressed through rollers; thus being converted into sheets of various width and thickness. When necessary, the sheets are again masticated, and again passed through rollers. These sheets are subsequently cut into boards, by vertical knives, placed at the further end of the table, along which the sheets are carried, by a cloth or web, to another roller, round which they pass, and are cut into the required widths. The bands, or straps, are then removed, and coiled up ready for use. Driving bands for machinery are thus made, and shoe soles and heels are stamped out of similar sheets of gutta percha.

In making tubes, or pipes, either of gutta percha, or any of its compounds, a mass of gutta percha, after being thoroughly masticated, is placed in a metal cylinder, furnished with a similar piston, by which it is pressed down into an air box, kept hot with steam, which has at its lower end a number of perforations, through which the plastic material is forced into a cup, whence it passes out, round a core, into the desired tubular form, and thence through a gauge to the required size, and into a receiver of cold water, being drawn to the other end of a long trough, by a cord passing round a pulley at the far end of the trough, and returning to the person in attendance on the machine, who gradually draws the pipe away from the air machine. Thus tubes of considerable length and diameter are made to a very great extent, and are used for the conveyance of water and other liquids, and are now under test for the conveyance of gas.

The paper next explained the variety of articles already made of gutta percha, which were of three classes:—1. Useful; 2. Ornamental; and 3. Useful and Ornamental combined. Various articles were then

exhibited, including two very handsome shields and a splendid communion dish and service.

Mr. Whishaw next exhibited the Telakouphanon, or Speaking Trumpet; and in doing so, said that speaking tubes of gutta percha were quite new, as was also the means of calling the attention, by them, of the person at a distance, which was accomplished by the insertion of a whistle, which, being blown, sounded at the other end quite shrilly. Attention having been thus obtained, you remove the whistle, and, by simply whispering, the voice would be conveyed quite audibly, for a distance of at least three quarters of a mile, and a conversation kept. It must be obvious how useful these telegraphs must become in large manufactories; and, indeed, in private houses they might quite supersede the use of bells, as they were so very cheap, and by branch pipes, could be conveyed to different rooms:—and, indeed, if there were no electric telegraphs, they might, by a person being stationed at the end of each tube of three quarters of a mile, or a mile, be made most speedily to convey intelligence for any distance. In private houses the whistle need not be used, but a more musical sound could be produced. He then amused the auditors, by causing the end of the tube, which was of the length of 100 feet, to be inserted into the mouth-piece of a flute held in a person's hand, regulated the notes, and placing his own mouth to the other end of the tube, "God save the Queen" was played at a distance of 100 feet from the person giving the flute breath. Turning to the Bishop of St. David's, he said that, in the event of a clergyman having three livings, he might, by the aid of three of these tubes, preach the same sermon in three different churches at the same time.

Mr. Whishaw also exhibited the gutta percha submarine rope, or telegraph; which consisted of a tube, perforated with a series of small tubes, for the conveyance of telegraphic wire, and which, for the purpose of preventing its being acted upon by sea water, or marine insects, was banded or braided round by a small rope; and its being perfectly air-tight would render it quite impervious to the atmosphere. Ibid.

Improved Hydraulic Valve.

This valve, proposed for hydraulic purposes, is a modification of the bucket valve, with this difference, that the bottom seat is increased to a sufficient area for a water way, and thus considerably lessens the lift of the valve, and ensures a steady action. It will be found to shut without rebounding, and consequently prevents the loss of water, the shock, and the wear and tear, which are found to attend most of the valves now at work, from having too much area exposed to the action of the water. The valves, again, being too light in proportion to their area, do not shut until the pole returns some inches. These disadvantages will, I have no doubt, be avoided by the application of the improved valve, represented in figs. 2, 3, 4, and 5, plate V.

John Poole, Jr.,

Copper House Foundry, Hayle, Cornwall.

Lond. Mec. Mag., June, 1848.

Gas Purifier. Alfred Henry Still, *of the Gas Light and Coke Company's Works, Shoreditch, Proprietor.*

Fig. 6, plate V., is a longitudinal section of this purifier. A A is a cylindrical case, and B is a shaft, which runs the whole length of the cylinder, A; it has its bearings in stuffing-boxes, which are placed around it, where it passes through the ends, C C, of the cylinder, and also in the upright bars, D D D. E E E, are a set of wooden rollers affixed on the shaft, B; they are studded with strips of whalebone, or other flexible material, throughout their whole length. A cross section of one of them is given in fig. 7. The cylinder, A, is filled to the height of the line *a b* with water, or a mixture of lime and water, or any other suitable liquid, or solution; the shaft, B, is made to rotate, by means of a band from some prime moving power, passed over the pulley, F. The gas to be purified is then allowed to escape through the pipe, G, and after passing through the machine, it escapes by the pipe, H. When a fresh supply of water, or lime and water, is required, the previous, or exhausted, charge is allowed to flow into the vessel, I, by means of the valve, K, from which vessel it can be subsequently removed through the door, L. The fresh material is supplied to the cylinder through the pipe, L. Ibid.

The Safety Lamp.

At a recent meeting of the Geological and Polytechnic Society of Yorkshire, the Rev. W. Thorp read a paper "On a New Safety Lamp, affording three times as much light as the Davy lamp, and quite as safe in the fire-damps of coal mines." The chief defect of the existing lamps was an insufficiency of light, which induced the workmen to withdraw the protecting wire gauze, or substitute a naked candle. In order to obtain more light, the Rev. W. Thorp introduces, with considerable ingenuity, the argand, or rather the solar burner, characterized by the circular wick, and the air admitted through its centre from the bottom of the lamp, protected, of course, by gauzes of wire. Connected with this part of the lamp, is an adjustment, placed outside of the cistern, by which the wick can, with the greatest ease, be raised or lowered. Over the light is applied a chimney of iron, based with a few inches of glass, with air admitted to supply the exterior of the flame, from the inside of the lamp. This is so securely fixed, that it cannot be displaced or broken, from the ordinary falls, or minor casualties, to which these lamps are liable to be exposed.

Having obtained the great desideratum—a much higher illuminating power, or more than five times the quantity of light the Davy lamp affords, or that equal to two mould candles generally used by miners; the next object being to insure perfect safety in every condition of the mine, there are inserted into the chimney four or five chambers of wire gauze, so that the flame of ignited gas has to traverse eight or ten meshes, before it can possibly reach the exterior fire-damp; but as one

mesh, as in the old lamp, is perfectly safe, unless exposed to a current, and as no lateral current of gas, or air, can be exerted upon the flame, on account of the chimney, the lamp is perfectly safe. And it is found, by any artificial means, utterly impossible to pass flame through these chambers of gauze, so that it appears to be quite safe under every circumstance and condition of the mine.

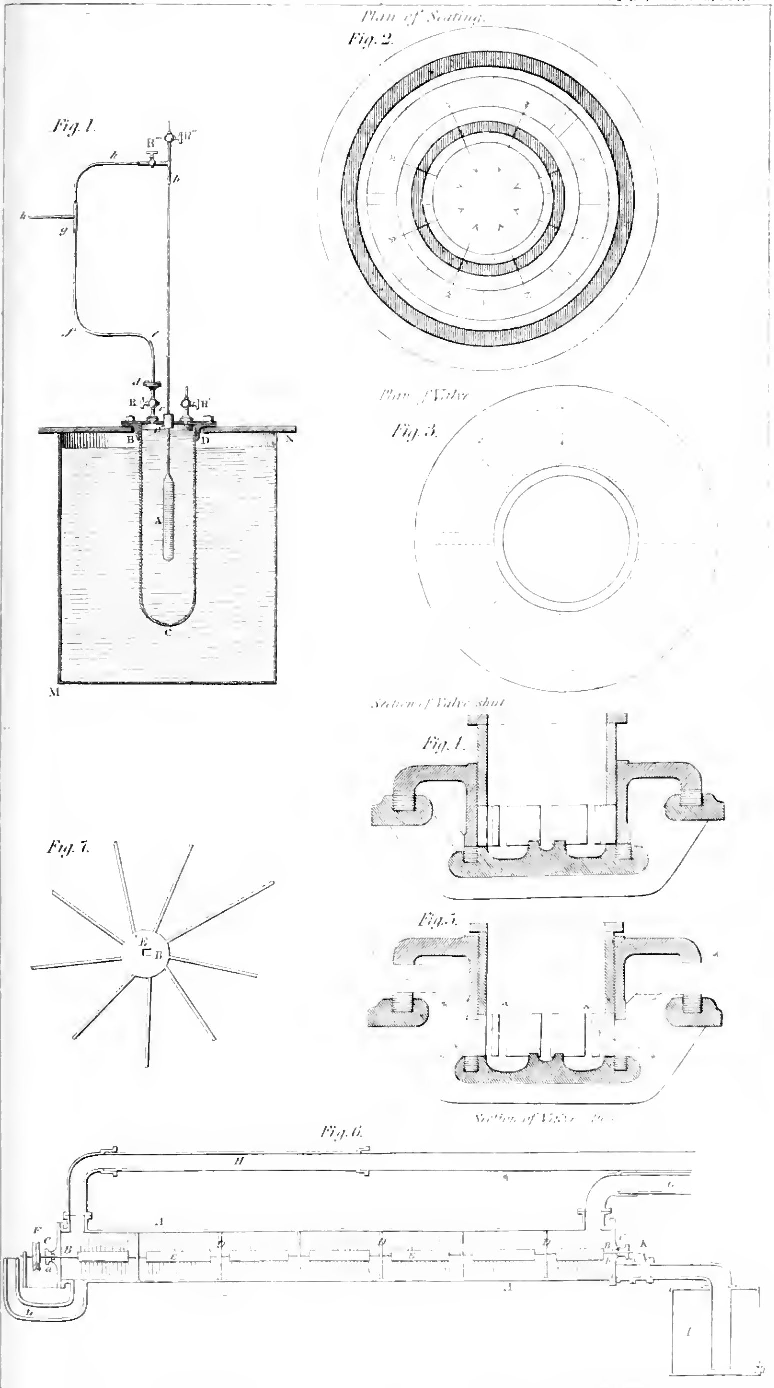
There are other advantages over the Davy lamp of no considerable value:—1. It requires trimming only once a week. 2. The oil does not fall out if laid on one side. 3. It is much more easily cleaned.—4. The cheapest oil can be used in it. The price of the lamp will be only 3s. or 4s. more (perhaps less) than the Davy lamp; and the latter can, at a small expense, (5s.,) be converted into the new lamp. A cast metal instead of a brass cistern can be made, by which the new lamp can be sold for even a less price than the Davy lamp.

London Artizan, March, 1848.

New Process for Engraving on Silver, or on Silvered or Gilded Copper. *By* M. Poitevin.

Some months since we published an ingenious method, discovered by M. Nièpce de Saint Victor, of counter-drawing designs and engravings upon paper, glass, or metal plates. M. Poitevin has succeeded in producing plates, engraved either in relief, or in sunk lines, from which proofs may be taken. For the carrying out of this process, from two to three hours only are required.

The engraving is first exposed to the vapor of iodine, which becomes deposited upon the black parts only. The iodized engraving is then applied, with slight pressure, to a plate of silver, or silvered copper, polished in the same manner as daguerreotype plates. The black parts of the engraving, which have taken up the iodine, part with it to the silver, which is converted into an iodide at those parts opposite to the black parts of the design. The plate is then put in communication with the negative pole of a small battery, and immersed in a saturated solution of sulphate of copper, connected with the positive pole by means of a rod of platinum. The copper will only be deposited on the non-iodized parts, corresponding to the white parts of the engraving, of which a perfect representation will thus be obtained;—the copper representing the white parts, and the iodized silver the black parts. The plate must be allowed to remain in the bath for a very short time only; for, if left too long, the whole plate would become covered with copper. The plate, after having received the deposit of copper, must be carefully washed, and afterwards immersed in a solution of hyposulphite of soda, to dissolve the iodide of silver, which represents the black parts; it is then well washed in distilled water, and dried. The next operation is, to heat a plate to a temperature sufficient to oxidize the surface of the copper, which successively assumes different tints, the heating being stopped when a dark brown color is obtained. It is then allowed to cool, and the exposed silver is amalgamated,—the plate being slightly heated, to facilitate the operation. As the mercury


Plan of Seating.
Fig. 2.
Fig. 1.
Plan of Valve
Fig. 3.
Section of Valve shut
Fig. 4.
Fig. 5.
Section of Valve
Fig. 6.
Fig. 7.

will not combine with the oxide of copper, a design is produced, of which the amalgamated parts represent the black, and the parts of the plate covered with oxide of copper, represent the white parts. The amalgamation being completed, the plate is to be covered with three or four thicknesses of gold leaf; and the mercury is evaporated by heat, the gold only adhering to the black parts. The superfluous gold must then be cleaned off with the scratch-brush; after which, the oxide of copper is dissolved by a solution of nitrate of silver, and the silver and copper underneath are attacked with dilute nitric acid. Those parts of the design which are protected by the gold, not being attacked, correspond to the black parts of the plate; the other parts corresponding to the white parts of the engraving, may be sunk to any required depth. When this operation is completed, the plate is finished, and may be printed from in the ordinary method of printing from wood-cuts.

To obtain, from the same prints, plates with sunk lines, similar to the ordinary engraved copper plates, a plate of copper, covered with gold, is operated upon. On immersion in the sulphate of copper solution, the parts corresponding to the white parts will become covered with copper. The iodine, or compound of iodine, formed, is then to be removed by the hyposulphite, the layer of deposited copper is oxidized, and the gold amalgamated, which may be removed by means of nitric acid,—the oxide of copper being dissolved at the same time. In this instance, the original surface of the plate corresponds to the white parts of the print, and the sunk or engraved parts to the black parts, as in the ordinary copper-plate engravings.—*Bulletin de la Société d'Encouragement.* **Lond. Journ. Arts, Sept. 1848.**

On Pseudoquina, a New Alkaloid. *By* M. Mengarduque.

M. Pelouze had in his laboratory an extract of cinchona, the source of which was uncertain; he gave it to the author for examination as an exercise. This substance was of a deep brown color, friable, very bitter, slightly soluble in water, soluble in acids, which it saturated like the alkaloids, and formed true saline solutions, from which water precipitated it as a pitchy mass. This matter, treated by the processes for the extraction of quina and cinchonia, did not yield the least trace of either of these alkaloids; nor was the cinchovatine of M. Manzine met with in it; but the author was so fortunate as to discover an alkaloid which he believes to be new, and which he so described, as to leave no doubt in the mind of M. Pelouze, who witnessed his experiments.

This alkaloid differs from the substances by which it is accompanied in the extract, in saturating acids more perfectly, insomuch that it expels ammonia from its compounds, like lime or barytes; it scarcely dissolves, even in boiling ether, and of these properties advantage was taken, in order to effect its separation.

The extract was boiled with an equal weight of hydrochlorate of ammonia, till ammonia ceased to be evolved. On cooling, a very abundant brown matter was deposited, of a syrupy consistence, upon which

floated a limpid liquid, of a light amber color. This liquor, poured off and filtered, was precipitated by ammonia.

The product thus obtained was yellowish and flocculent, susceptible of softening, and agglutinating by heat. It was dried and treated with cold ether, which dissolved the greater part of it, and left a pulverulent white matter, which was the new alkaloid in a state of purity

This product, thus purified, possessed the following characters: subjected to heat, on platina foil, it fuses, and then burns with a blue flame, without leaving any residue. It is insoluble in water, and insipid, soluble in alcohol, and much more so when hot than cold; its alcoholic solution readily crystallizes in irregular prisms; it is soluble in the mineral, and in organic acids, even diluted; it is insoluble in ether.

Ammonia, potash, and soda, precipitate it from its saline solutions; water precipitates it from solution in alcohol. Lastly, if it be dissolved in aqueous solution of chlorine, and ammonia be added, the liquor assumes a reddish-yellow color. It is well known that quina, similarly treated, yields a green solution.

Its solution in sulphuric acid may be rendered neutral to litmus paper; it is but slightly bitter. By evaporation, it yields fine crystals, which are flattened prisms beveled at the summits.

The solution in hydrochloric acid had all the properties of an hydrochlorate, but it could not be made to crystallize.

By analysis it yielded—

	I.	II.
Carbon, . .	76·5	76·7
Hydrogen, . .	8·1	8·2
Nitrogen, . .	10·2	10·4
Oxygen, . . .	5·2	4·7
	100·0	100·0

The author concludes, from the chemical and physical properties of this substance, and especially from its composition, that it is a new alkaloid.—*Comptes Rendus*, Août, 1848,

Lond. Edin. & Dub. Phil. Mag., Oct. 1848.

Preparation of Meta-Antimoniate of Potash as a Test for Soda.

M. Fremy observes that, since the publication of his first memoir on the antimoniates, the meta-antimoniate of potash has been generally employed in laboratories as a test of the salts of soda; and as the preparation of this salt has been found difficult by several chemists, the author states the following to be the process which he now employs, and by which he obtains in a few hours nearly two pounds of meta-antimoniate of potash.

He begins by acting upon one part of antimony with four parts of nitre, in a red-hot earthen crucible; insoluble anhydrous antimoniate of potash is formed, which is washed with cold water, to remove the nitrite and nitrate of potash, an excess of which it usually retains.

The antimoniate of potash is then boiled for two or three hours in water, in order to convert it into the gummy soluble antimoniate; water is to be added to supply the loss by evaporation. During ebullition, the greater part of the antimoniate dissolves, there remaining but a small quantity of bi-antimoniate of potash, which is separated by the filter.

The solution of the gummy antimoniate of potash is then evaporated, adding to it several fragments of pure hydrate of potash, so as to render it very caustic. A few drops of the solution are tried from time to time, to see whether, on cooling, they become crystalline; and when this takes place, the evaporation is to be discontinued, the meta-antimoniate of potash then crystallizing abundantly; the alkaline solution is to be poured off, and the salt is to be dried on porcelain plates.

This salt always contains an excess of alkali; it ought to be washed two or three times before it is used as a reagent. As the meta-antimoniate of potash decomposes in solution in water, it is proper to keep it in the dry state, and to dissolve it at the moment in which the trial is to be made.

To make an examination, which scarcely requires ten minutes, about fifteen grains of the potash to be tried, should be dissolved in a small quantity of water, and supersaturated with hydrochloric acid, and the solution is to be evaporated to dryness, in a porcelain or platina capsule. The chloride of potassium, being then perfectly neutral, is re-dissolved in water, and treated with the solution of meta-antimoniate of potash. If the potash contains 2 or 3 per cent. of soda, a precipitate is almost instantly formed; but if the quantity be smaller, time and agitation will be necessary to effect precipitation.

M. Fremy states the sensibility of this reagent to be so great, that he found, by synthetic experiments, he could detect a half per cent. of carbonate of soda in commercial potash.—*Ann. de Ch. et de Phys.*, Août, 1848. Ibid.

Copper Smelting at the Royal Saxon Works, at Freyberg.

As this important subject has so fully occupied your columns, the following observations, communicated to me by Prof. Kerstens, the principal comptroller of the Royal Saxon Works, at Freyberg, may be not unacceptable to your readers. The furnaces used here, are an improvement on the blast system pursued in the Hanoverian and Prussian Government works. He says, they smelt about 700 German quintals of ore, which give about 200 quintals of coarse metal, containing about 70 quintals of copper. The calcining of the coarse metal will produce 150 quintals of calcined metal, and by again melting and refining, will be obtained 60 quintals of pure copper—this being the produce of 700 quintals of copper ore in one of our furnaces per week; I have calculated 10 per cent. loss of copper as results at Freyberg.—The constant operation of one furnace, properly constructed, and costing about £60, lasts three or four months without interruption. Coke is the only fuel used, and considered the most advantageous. On an

average of five years' smelting, 100 quintals of ore, through all the processes, consume 4 cubic metres of coke—1 cubic metre of coke is equal to $2\frac{845}{1000}$ cubic metres of charcoal. By using coke as fuel, they always obtain a greater produce of metal than by charcoal, or pitcoal. The Freyberg coal gives 68 per cent. of coke. The cubic metre is reckoned to contain 61,023·50 cubic inches, which, reckoning 1728 cubic inches to a cubic foot, will make the metre equal to 35·31 cubic feet. The cubic foot of coke weighs about 24 lbs. In the first reduction, it is reckoned that 1·492 cubic feet are required to smelt 1 cwt. of copper, and that it would take 29·84 cubic feet of coke to smelt an English ton, which is equal to $13\frac{92}{100}$ cwts. of pitcoal. C.

London, Sept. 12, 1848. Lond. Min. Journ., No. 682.

The Coloring Property of Madder.

Dr. Edward Schunck presented to the Chemical Section of the British Association, his third report on the coloring property of madder. The extractive matter of madder-root contains seven different substances, only one of which, however,—the alizarine—is of value for its color; all the others, indeed, tend to impair the color yielded by alizarine; and the chief use in adding lime to madder in dyeing is, that it combines with the other substances, and renders them harmless.—Potass, or other alkalies, would have a similar effect; but as lime is cheaper, there would be no advantage gained in substituting alkalies. It was suggested that a practical application might be made of the analysis, by extracting the alizarine in a separate state, freed from the injurious adjuncts, in which condition, it was hoped, a better and more durable pigment might be obtained, especially in the madder lakes. The experiments have, however, been so recently made, that no practical results can as yet be expected.

Civ. Eng. & Arch. Journ., Sept. 1848.

Coal and Iron.

Mr. Booker, being called on by the President for some statistical information, stated that there were 159 blast furnaces in the district employed in smelting iron, and that 550,000 tons of iron were annually manufactured. The coal raised in the district was employed as follows:

1,500,000	tons annually in the manufacture of iron.				
200,000	"	"	"	"	copper.
150,000	"	"	"	"	tin.
750,000	" employed in domestic purposes and in agriculture.				
1,750,000	" exported.				
4,350,000	tons per annum.				

At this rate, and supposing the coal to exist only over 100 square miles, there was sufficient for 1400 years to come. The value of the exports from the district, consisting of iron, &c., in a state of rough manufacture, amounted to £4,000,000 a year.—*Trans. Br. Assoc. for the Adv. of Sci.* Lond. Athen., Aug. 1848.

FRANKLIN INSTITUTE.

Committee on Exhibitions.

Report of the Eighteenth Exhibition of American Manufactures, held in the city of Philadelphia, from the 17th to the 28th of October, inclusive, 1848, by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

The Committee on Exhibitions of the Franklin Institute, respectfully present the following report of their Eighteenth Exhibition of American Manufactures which is now about closing.

They congratulate themselves and all who take an interest in the success of our manufactures, upon the renewed evidence which this Exhibition has afforded of the rapid improvement of our arts and our power to maintain ourselves, independent of all foreign nations for the supply of our wants and luxuries. It is not necessary to assert the advantageous influence which these exhibitions exert in promoting the growth of our domestic manufactures. Their rapid spread among our neighboring cities, and their extension to the west among communities which are destined in their turn to vie with us in wealth and importance, prove their importance, and render it a useless task to undertake their defence. But there is one point to which we may be perhaps permitted to call your attention—that is, to the immense and beneficial influence which they have exerted in promoting among our people the taste for American goods. Not many years have passed since the fashion of the country required to be gratified with imported goods, and the products of our own manufactories were frequently sold as foreign. At present, this fashion, if not entirely eradicated, is at least greatly checked. The public taste has been directed in a more honorable course. We begin to have a pride in making use of our own materials, fashioned by our own industry, and the use of fraudulent labels becomes every year more and more difficult, when the public may see the articles in our Exhibitions and satisfy themselves as to their origin. The practice, it is believed, however, is not yet entirely done away with, and we confidently appeal to you, the manufacturers and mechanics of the country, to assist us in our endeavor to put an entire stop to a practice, which in more than one point of view is a deep disgrace to us as a people.

The number of articles deposited with us for exhibition this year is unusually large; but the Committee regret that a large portion of them were brought in at so late a period as to prevent them from being, under the regulations, presented to the judges for their opinion. The experience of the Committee has shown how necessary their regulations upon this subject are, and they are entirely convinced of the importance of adhering rigidly to them. The small number of goods which arrived too late for the judges, at the Exhibition for 1847, had taught them to hope that the depositors themselves were convinced of the correctness

of their policy, and they regret to see a relapse upon this point, which, however, they hope they will not again have occasion to advert to.

The articles submitted for competition have been referred for their examination to judges who were carefully selected for their knowledge in the particular departments of the arts, and for their impartiality, and upon their judgments expressed in writing, the Committee have founded their awards of premiums.

It is perhaps impossible among so many and such various articles, to prevent oversights and errors, by which a meritorious individual may be deprived of his due reward; still more so, to give to each the full share of praise, which he naturally supposes is due to his exertions. All that the Committee can claim is, to have done every thing in their power to avoid such accidents; to have fulfiled the duties which have devolved upon them with earnest zeal and impartiality; and to hold themselves ready to investigate, and as far as lies in their power, to repair any injury which may have inadvertently been inflicted upon any one. On these points they feel assured that the depositors and the public will do them the justice which they deserve.

Our present exhibition, although a large one, and as remarkable for the quality as for the number of the articles exhibited, is, we cannot deny, a very uneven one. Certain departments, which have heretofore contributed much to its value and interest, being now either almost entirely wanting, or very deficient in interest, while others have assumed an importance which they have never before indicated; and some which have been considered in former exhibitions as perfect as could be expected or imagined, now show well marked improvement. Into the reason of this it is not our province at present to inquire, but we hope that it will be rectified in future by the deficient branches coming up to the highest standard.

The following is a summary of the reports of the judges in which it is believed, no article has been omitted which was favorably noticed by them:

I.—*Cotton Goods.*

The judges regret to observe that the specimens of cotton manufactures furnished for the annual exhibition, seem to decrease in variety and style every year.

They recommend, and the committee have awarded the following premiums.

No. 38. Bird eye diaper and crash, made by Henry H. Stevens & Co., Webster, Mass., and deposited by Hacker, Lea & Co.,

A First Premium.

These we believe to be the first linens made by power loom in the United States, and the judges are pleased to see the beginning of what may at no very future day become a very important branch of manufactures.

No. 612. Ginghams, made and deposited by William Smith, of Philadelphia. They are superior to any which the judges have ever seen. *A First Premium.*

No. 20. Ginghams made by Ida Mills, Troy, N. Y., and deposited by John W. Downing, *A Third Premium.*

No. 41. Cotton flannels, made and deposited by Garsed & Brothers, Frankford, Pa., *A Third Premium.*

The following articles are favorably noticed.

No. 19. Bleached muslins, from the Ida Mills, Troy, N. Y. These goods, it is believed, have received premiums on several former occasions, but as they do not excel either in quality or style what has been heretofore furnished by the same concern, the judges do not consider them as entitled to any thing more than a favorable notice.

Nos. 25 to 29. Silesias and bleached cottons, from the Lonsdale company, Providence, R. Island. The specimens fully sustain the good reputation which the fabrics produced by this company have long enjoyed, but the judges see no improvement either in the style or finish.

The steam purple and chintz furnitures, from the Messrs. Chapin, Fall River, Mass., show an improvement in this class of work.

No. 53. Brown sheetings, from Penn Mills, Pittsburgh, Pa., are very fair specimens of sheetings, and while they do not excel those exhibited last year, are worthy of notice.

Nos. 57 to 60. Specimens of bleaching from Goodall & Co., Philadelphia, fully sustain their former reputation.

No. 4. Two cases of bleached cotton shirtings, bleached and deposited by John Shepherd, South Trenton, New Jersey. Very well finished for coarse goods.

No. 6. Patent seam duck, made by Jas. Maull, Baltimore, Md., deposited by Jas. Maull, Jr., Philadelphia. The patent seam consists of an increased quantity of chain for the space of an inch or a little more, in the centre of cotton duck of the usual width used for sails, and is intended to supersede bited sails. The improvement is novel, and adds much to the beauty of a sail, but being very recently introduced, its value cannot yet be attested to.

II.—*Woolen Goods.*

The judges notice with regret that the display of woolens is far inferior both in quantity and quality to former exhibitions.

They make the following awards.

To No. 3. Black satinett, made by Camp & Morris, Woodbury, Conn., deposited by D. B. Hinman & Co., a very superior article, *A First Premium.*

No. 74. Green and scarlet blanket coating, made by the New England Worsted Comp., deposited by Pease & Foster—splendid goods. *A First Premium.*

No. 84. Fancy woolen shawls, made by the Waterloo Comp., Waterloo, N. Y., and deposited by Tredick, Stokes & Co., *A First Premium.*

No. 33. A shawl, made by Duncan & Cunningham, and embroidered by Miss Bigler, of New Jersey. For the beauty of design and superb workmanship, *A First Premium.*

No. 43. A lot of fancy zephyr goods, made and deposited by J.

Hoffman, Mantua Village, Pa., a new branch of industry and worthy of encouragement. The specimens, beside being splendid in quality, show evidences of great skill in manufacture, *A First Premium.*

No. 40. Wool black cloths, made by W. & D. D. Farnham, Waterford, Conn., deposited by Ellison & Peters, a very superior article, and worthy of all commendation. A first premium was awarded last year to duplicates of the above.

No. 83. Piece-dyed black cloths, made by the Utica Globe Mills Company, Utica, N. York, deposited by Tredick, Stokes & Co. These goods, though ordinary in quality, are entitled for their superior taste and finish to a *A Third Premium.*

The judges also mention with approbation,

No. 78. Fancy cassimeres, made by the New England Company. Rockville, Conn., deposited by Tredick, Stokes & Co.

No. 8. Black cassimeres, made by the Seneca Woolen Mills, N. Y., deposited by Dulles & Aertsen.

No. 75 & 76. Brown mixed blanket coatings, made by the New England Worsted Company, deposited by Pease and Foster.

No. 17. Cotton blankets, made and deposited by Wm. Curry, Philadelphia. A new article.

No. 46. Plaid cloakings, cotton and wool, made by P. & D. Hickey. Philadelphia, deposited by C. H. Welling.

No. 51. Cotton pantaloon stuffs, made and deposited by J. C. Kempton, Manayunk, Pa.

No. 10. Worsted drawers, made and deposited by Wm. Brown. Philadelphia, a new and creditable article.

No. 70. Merino shirts and drawers, made by the New Britain Company, Concord, Mass., and deposited by Williams & Co.

No. 30. Woolen hosiery, made by J. Beck, Berks Co., Pa., deposited by A. Durell.

III.—*Carpets.*

The judges on carpets regret that with the known improvements that have been made in the manufacture of carpets within the past year, so few specimens have been sent for exhibition. Of those exhibited they consider

No. 412. Tapestry, Damask Venetian, manufactured by A. M'Callum & Co., and

No. 376. Four rolls Brussels, manufactured by J. Rosencrantz, Philadelphia, entitled to *First Premiums.*

The former is a new style of Venitian carpets, that has been but recently attempted to be manufactured in this country, and in colors, quality and style will compare very favorably with the best English of the same kind. The latter is a decided improvement upon last year's specimens, and in quality, is equal to the best English Brussels, and being a new article of but limited manufacture in this country, is well worthy of the favorable notice of the Institute.

No. 304. Table and piano covers, made by G. D. H. Mensing, Philadelphia, deposited by Henry & Thomas, are very handsome styles

and durable quality, resembling the French article of the same kind. As table covers of this description are so rarely manufactured in this country, they think these worthy of *A Second Premium.*

No. 373. Stair oil cloth, made and deposited by Isaac Macauley, Trenton, N. J. In these lots they mark some improvement upon last year's specimens, in their finish and appearance.

IV. *Silk Goods.*

The judges recommend the following awards:

No. 1. Embroidered capes, handkerchiefs, dresses, &c., manufactured by John Egan, Philadelphia. This is an entirely new branch of manufacture, and worthy of the particular notice of the Institute. The articles exhibited will compare very favorably, both in quality and price, with imported goods of the same description. The committee, in accordance with the report of the judges, recommend to the Institute, to award a gold medal. Mention should also be made of Mr. King, the designer of the patterns. These are believed to be the first goods of this description made in this country.

No. 37. Five pounds, 10 bundles, blue sewings, made by Colt & Co., deposited by Hacker, Lea & Co. This is a very good article and worthy of *A Second Premium.*

No. 64. Colored sewings, made and deposited by J. E. & T. S. Hovey, Mansfield, Ct. The judges consider this the best article of colored sewings exhibited, and for beauty of finish and brilliancy of color equal to the Italian. *A First Premium.*

No. 72. Cases of silk fringes and buttons, made and deposited by Hastings & Dewey, Philadelphia. The judges have carefully examined these fringes, and take pleasure in directing the attention of the Institute to them. They are superior to the imported article, and are thoroughly American. Designed by Messrs. H. & D., the silk dyed and finished in this country. *A First Premium.*

No. 101. One case sewing silk, made by Cheney & Bro., Manchester, Connecticut, deposited by Todhunter & Sill. The black sewings, the judges consider the best specimen in the exhibition, quite equal to the most of the Italian imported and worthy of *A First Premium.*

The sample of colored sewings, the judges do not consider equal to that of No. 64. *A Second Premium.*

The judges notice favorably

No. 33. Silk and wool vesting, made and deposited by Jas. Campbell, Delaware Co., Pa.

No. 68. Spool silk, made by John Kyle, Paterson, N. J., deposited by W. H. Horstmann & Sons, a good article, and worthy of notice for the manner in which it is put up.

V. *Iron and Steel.*

The judges remark that this branch is represented in the present Exhibition, in a manner creditable to the great Iron interests of our country. They award the following premiums:

No. 1661. Two sheets Boiler Iron from the Thorndale Iron Works,

Chester county, Pa., J. & J. Forsyth & Son, deposited by Morris & Jones & Co. They are of unusual size—46 inches wide by about 14 feet long. Also two circular plates for boiler ends, about 55 inches in diameter, by 5-8 thick. These they consider superior specimens, the two first being the widest sheets of boiler iron ever exhibited. *A First Premium.*

No. 1693. Three bars rail road Iron made and deposited by Reeves, Buck & Co., Philadelphia. Also cuttings from the ends of the rails to show the quality of the iron. For the general excellence of the specimens, *A First Premium.*

No. 1655. A large lot of rolled Iron by Moore & Hooven, Norristown, Pa., deposited by Morris & Jones & Co., are believed to be fully equal to the specimens exhibited in 1847, for which they were awarded *A First Premium.*

No. 1663. A lot of boiler rivets by the Dover Works, N. J., deposited by Morris & Jones & Co., well made and superior to any heretofore deposited, *A Third Premium.*

No. 1586. Two patterns of double rail road Iron, by A. B. Seymour, Bordentown, N. J. *Referred to Committee on Science and Arts.*

The judges speak in favorable terms of

No. 1518. Verandah Iron, by Heins & Adamson, Philadelphia.

No. 1558. A lot of wire railing and cylinder coal screen, by Wickersham & Hamlin, Philadelphia.

No. 1637. A Muley Mill Saw, by W. & H. Rowland, Philadelphia.

No. 1644-45. Lot of butt welded Iron tubes, by Morris, Tasker & Morris, Philadelphia. The judges express a hope that since these gentlemen have succeeded so well in this branch of manufacture, they will turn their attention to the lap welded tubes, and thus render us independent of a foreign supply.

No. 1646. A lot of valve stop-cocks, by the same.

No. 1647. Two coils of Iron tube, from the same.

No. 1652. A casting for a grate front, from the same.

No. 1653. A lot of small cast iron water pipes, from the same.

No. 1638. A lot of blistered steel, by W. & H. Rowland, Philadelphia. The judges have had no opportunity of judging of its quality. Also a bundle of spring steel, from the same.

No. 1640. A lot of wire work, from Watson & Cox, Philadelphia.

No. 1658. Scroll Iron from the Kensington Iron Works.

No. 1659. Boiler Iron from the Pottsville Iron Works, Montgomery county, Pa., H. Potts & Co., deposited by Morris & Jones & Co.

No. 1660. Boiler Iron from the Triadelphia Iron Works, Chester county, Pa., J. Yearsley & Bro., deposited by the same.

No. 1664. Sheet Iron, by McCollough & Co., Delaware, deposited by the same.

No. 1677. An Iron bedstead, by Heins & Adamson, Phila.

No. 1688. Hammered Iron, by D. Schall, Berks county, Pa. deposited by W. F. Potts, Philadelphia.

The judges would suggest the propriety of giving notice to depositors of Iron and Steel, to furnish samples of the kind they intend to deposit some time previous to the Exhibition, to allow time to submit them to the proper tests.

They would also renew their commendation of Messrs. Morris & Jones & Co., for their unwearied exertions to promote the objects of the Institution.

VI.—*Umbrellas.*

There is but a single lot deposited in time for the inspection of the judges.

No. 9. 1 Case of Pearl Mountings for Parasols, Umbrellas and Knives, made and deposited by S. H. Lowber, Philadelphia.

The articles are in good taste, and exhibit a skill in manufacture equal to that shown by any imported articles.

The judges recommend the award of *A Third Premium.*

VII. *Lamps and Gas Fixtures.*

The judges report that they have examined the articles exhibited in this department, with much care, and are of opinion that they afford evidence of continued progress in improvement.

They recommend as follows:

No. 1274. Lamps and Gas Fixtures by Cornelius & Co., Philadelphia. They would call attention to the beautiful chandeliers, in which much good taste is combined, with equal skill in the arrangement and finish of the profusion of ornamental work with which they are covered. An award of a gold medal was given to these gentlemen by the Institute last year for chandeliers in no respect superior to those now exhibited. Had it not been given on that occasion, it would certainly be due to them on this.

No. 1336. Lamps, Chandeliers, &c., by Archer & Warner, Philadelphia. This array is highly creditable to the skill of the Manufacturers. Some of their silvered and damask articles are especially well finished. Their parlour gas pendants are also highly creditable. The judges deem these and their bracket lights of novel and spirited design, deserving, *A First Premium.*

VIII.—*Hardware and Cutlery.*

The display under the notice of the judges is by no means as extensive as heretofore, although it is highly creditable to the different manufacturers. The judges can safely say, that much more care has been paid to the finish of the goods, together with many improvements in articles, which will prove beneficial to all parties concerned.

There have been very few, if any articles in this line submitted to your judges which do not reflect credit upon their makers, and sustain a landable reputation.

They are as follows:

No. 604. Door spring, made and deposited by J. B. Wells, New York. *A Third Premium.*

No. 606. A lock, by F. C. Goffin, Trenton, N. J., of very ingenious construction. *Referred to Committee on Science and Arts.*

No. 609. Emery paper made and deposited by Robt. Boyd, N. Providence, Delaware Co., Pa. The best article of its kind. *A Third Premium.*

No. 610. Horse shoes, made and deposited by W. M. Leach, Philadelphia. They are truly beautifully finished articles, equal to any thing of the kind ever exhibited. *A Third Premium.*

No. 613. Stencils by S. H. Quint, Philadelphia. *A Third Premium.*

No. 617. Guns and pistols, by John Krider, Philadelphia. These articles are of very good finish, equal to any thing of the kind made in this country or any other. The pistols in particular are a master piece of work. *A First Premium.*

No. 621. Adjustible metallic throat piece for planes, by B. F. Schelabarger, Mifflintown, Juniata Co., Pa.
Referred to the Committee on Science and Arts.

No. 624. A lot of saws, by Hoe & Co., New York, deposited by Edward Frith. A very handsome display of goods, particularly the circular saw, which is finished in very superior manner, and appears to be very true. *A First Premium.*

No. 648. Cast iron molasses gates, made by Benedick & Ball, Chicopee, Mass., deposited by Steinmetz & Justice. They are good articles, well finished, and answer an excellent purpose. *A Third Premium.*

No. 637. Stocks, dies, and taps, made and deposited by B. Martens, Philadelphia, equal in all respects to previous specimens which obtained the first premium.

No. 639. Brass work, &c., made and deposited by J. and H. Jones, Philadelphia, sustains the reputation of the makers. They are of beautiful finish, and for the display the makers are entitled to *A First Premium.*

No. 644. Castings, by Savery & Co., Philadelphia, as good as ever made. For their enameled ware of various kinds, Messrs. S. & Co., are entitled to all credit which can be given them. *A First Premium.*

No. 645. Tailors' shears, made by R. Heinish, Newark, N. J., deposited by C. H. Harkness, fully equal to former specimens, for which they received a first premium.

No. 661. Machine and hand cards, made by J. D. Sargeant & Co., Leicester, Mass., deposited by Billington & Emery, a good article worthy of the notice of manufacturers. *A Third Premium.*

No. 666. Vices and anvil, made by Fisher & Martin, Newport, Maine, deposited by Curtis & Hand.

No. 663. A lever vice, by J. S. Griffing, New Haven, Ct.

The vices are a serviceable article, and calculated to answer a very good purpose, but the judges not being able to decide about the anvil, would refer the whole subject to the *Committee on Science and Arts.*

No. 664. Locks and latches, made by Pierpont, Mallery & Co., New Haven, Ct., deposited by Curtis & Hand, a very handsome display of excellent goods. *A Second Premium.*

No. 666. Patent chain bolts, made by O. & C. Bush, Fall River, Mass., deposited by Curtis & Hand. This bolt is intended to take the place of tail bolts, which it will no doubt do in many instances where the old style of bolt would be too expensive. This article combines length and strength sufficient for ordinary purposes. *A Second Premium.*

No. 670. Cast iron bell levers, made by J. H. Pugh, Philadelphia, deserving attention, as they will answer all the purposes of the old style brass at much less cost and equally durable,—they are very neat.
A Third Premium.

No. 675. Assortment of bits, by J. M. Fisher, Philadelphia, a very handsome display of good serviceable goods. *A Second Premium.*

No. 677. Dental and other files, made by R. Murphy, Philadelphia. Equal to former specimens, for which he has received a first premium.

No. 679. Patent Gun, by A. Wurfflein, Philadelphia. Beautiful workmanship. *Referred to the Committee on Science and the Arts.*

No. 683. Guns, pistols and locks, made by W. Robertson, Philadelphia. A good substantial article. *A Second Premium.*

No. 688. Gilt buttons, made by F. Hayden & Son, Waterbury, Conn., deposited by D. D. Byerly. Elegantly finished articles, and well worthy of *A Third Premium.*

No. 692 and 693. Reveal and common shutter hinges and wrought bolts, made by Heins and Adamson. Very excellent goods, finished in first style, creditable to the makers. *A Second Premium.*

No. 694. Weavers' reeds, made by J. A. Gowdy, Providence, R. I., deposited by J. K. Devine. These are first class goods, and of beautiful finish, and worthy *A First Premium.*

No. 1265. Plano-relievo plates for doors, made by Jacob Maas & Sons, deposited by W. A. Maas. These are handsome and good articles, well deserving of attention. *A Third Premium.*

No. 1210. Stencils made and deposited by E. B. Foster, equal in all respects to No. 613, and like them entitled to *A Third Premium.*

The judges speak favorably of

No. 601. Augers and gimlets, made by A. Conrad, Whitemarsh, Montgomery co., Pa., deposited by S. H. Bibighaus. A good article and sustains the reputation of the maker.

No. 603. Sand paper, made by R. H. & J. G. Ishard, N. Y., deposited by Lewis S. Peck.

No. 605. Iron brands, made and deposited by M. Costello, Phila.

No. 656. Iron brands and stamps, made by J. Franklin & Son, Philadelphia. Very creditable to the maker.

No. 608. Scythes, made by Mansfield & Lamb, Smithfield, R. I., deposited by Dilworth, Branson & Co.

No. 609. Sand paper, made by R. Boyd, N. Providence, Delaware co., Pa., deposited by Dilworth, Branson & Co.

No. 611. Candle moulds, made by W. McQuilkin, Philadelphia.

No. 614. Razor Strops, made and deposited by L. Chapman, Philadelphia.

No. 615. Spades, forks, &c., made and deposited by Prouty & Barrett.

No. 619. Coffee mills, by W. C. Lawson, Philadelphia.

No. 620. Patent combination locks, by S. W. Colton, Philadelphia.

No. 1567. Machine cards, made by Jas. Smith & Co., Philadelphia.

No. 623. Gum elastic door springs, made by Ames & Newell, Wadawanuck, Connecticut, deposited by Cresson, Fisher & Co.

No. 626. Shoe knives, made by Moran & Fulton, Mansfield, Mass., deposited by E. Lewis.

No. 627. Six scythes, made by Roby & Sawyer, N. Chelmsford, Massachusetts.

No. 629. Blind hinges and blind fixtures, American Window Trimming Co., Taunton, Mass., deposited by L. S. Talbot,

No. 630. Cast iron molasses gate, made by Benedict & Ball, deposited by S. Hart, jr.

No. 631. Stair rods, made by M. Gold, Philadelphia.

No. 642. Six planes, made by E. W. Carpenter, Lancaster, Pa., deposited by W. M. McClure.

No. 647. Wood screws, made by the Hartford Hardware Co., Hartford, Conn., deposited by Steinmetz & Justice.

No. 649. Chisel, made by Wilcox & Co., deposited by Steinmetz & Justice.

No. 650. Hoe, made by E. C. Tuttle, Naugatuck, Conn., deposited by Steinmetz & Justice.

No. 651. Patent axle pulley, made by Judd, and deposited by Steinmetz & Justice. Has the advantage over the former style in some respects, and a very well made article.

No. 1718. Shuttles, made by Vanhorn & Heller.

No. 665. Molasses gates, made by Gifford & Chase, deposited by Curtis & Hand.

No. 676. Butcher's knives, Bradshaw & Purlee, N. York, deposited by E. Lewis.

No. 684. Wrought hinges, A Roy & Co., Watervliet, New York, deposited by Thompson, Carr & Co. Sustain their reputation.

No. 696. Brace and bitts, made by John Gardiner, Philadelphia.

No. 697. Rifle, made by A. K. Brown, Philadelphia.

No. 698. Shoemakers' tools, made by C. H. Blittersdorf, Phila.

No. 699. Lock, made by C. Crawford, Philadelphia.

No. 700. Rifle barrels, made by C. Lehman, Lancaster co., Pa.

No. 701. Planes, made by Colton & Sheneman, Philadelphia.

No. 721. Files, made by Ankrim & Co., Pittsburg, deposited by M. W. Baldwin.

No. 711. A case of saddlers' tools, &c., by H. Huber, jr., Philadelphia. These beautiful goods fully sustain, in all respects, the reputation of the maker.

IX. *Saddlery and Harness.*

The judges report the display of Saddlery and Harness as exceedingly meagre, and decidedly inferior to that of previous exhibitions. They regret, that while the Saddle and Harness Makers of this city produce very beautiful specimens of their art, so few should find their way into the Exhibition.

The display of trunks and valises is good.

They award as follows:

No. 389. One set double harness, made and deposited by A. C. Ingram, Philadelphia. Substantial workmanship. *A Third Premium.*

No. 377 and 403. Two saddles, made and deposited by Wm. H. Hawkins, Philadelphia. *A Second Premium.*

No. 338. One case harness ornaments, made and deposited by C. G. Smith, Philadelphia. Handsome design and workmanship.

A Second Premium.

No. 350. Valise trunk, carpet bags and ladies satchels, made and

deposited by Thos. W. Mattson, Philadelphia. More than sustains his reputation. *A First Premium.*

No. 365. Two trunks, made and deposited by John Unruh, Philadelphia. Sustain the reputation of maker. *A Second Premium.*

No. 402 1-2. Bridle, made and deposited by Henry Seitz, Columbia, Lancaster co., Pa. *Referred to Committee on Science and the Arts.*

The judges notice favorably,

No. 313. One card harness ornaments, made by J. L. Seiger, Baltimore, Md., deposited by Geo. Booth.

No. 369. Cart saddle with elliptical springs, made by John Harman, deposited by John Case.

No. 323. Trunk, made and deposited by Thos. W. Mattson, Phila.

No. 274. Two sole leather trunks, and two carpet bags, made and deposited by Jacob Moyer, Philadelphia.

No. 378. Traveling sea trunk, made by J. Sebe, Wilmington, Del., deposited by Gillis & Ruggle.

No. 379. Trunk, made by Isaac Hammitt, Philadelphia.

No. 391. Three trunks, made and deposited by E. P. Moyer, Phila.

X. *Models and Machinery.*

The judges make the following awards:

No. 1506 and 1507. Coupling joints, by West & Thompson, N. Y. Already referred to *Committee on Science and the Arts.*

No. 1519. Whip saw machine, by Benjamin Ingram, Philadelphia. *A Third Premium.*

No. 1526. Progressive Lever Presses, by David Dick, Meadville, Crawford county, Pa. *Referred to Committee on Science and the Arts.*

No. 1530. Barrel Machine, by Wm. Trapp, jr., Philadelphia. *A First Premium.*

No. 1533. Marine Hydrometer and Marine Clock, by Stillman, Allen & Co., N. Y., deposited by D. G. Wells. *Referred to Committee on Science and the Arts.*

No. 1538. Direct Action Steam Pumps, by C. W. Fulton, Baltimore. *Referred to Committee on Science and the Arts.*

No. 1576. Model Steamboat wheel, by R. L. Curry, Philadelphia. *Referred to Committee on Science and the Arts.*

No. 1579. Centre vent Water wheel, by Thatcher, Boston, Mass., deposited by E. Tuttle. *Referred to Committee on Science and the Arts.*

No. 1720. A shaft spring, invented by T. S. Speakman, Philadelphia, made and deposited by Heins and Adamson. *A Third Premium.*

The judges mention favorably the following:

No. 1520. Patent filtering cocks, by Wm. Sweet, N. Y.

No. 1529. Ruggles' Card Press, by M. Ruggles, Boston, Mass.

No. 1565. Platform Scales, by Ellicott & Abbott, of Philadelphia.

No. 1683. Scale Beams, by D. T. Stuart, Philadelphia.

No. 1689. Platform Scales, by E. & T. Fairbank, St. Johnsburg, Vt., deposited by G. B. Norris.

No. 1590. Porter's Dray, by Wm. Snider, Philadelphia.

No. 1602. Machine for Morticing and boring Hubs, by John McClintock, Philadelphia.

No. 1603. Mortising machines, do. do.

No. 1686. Self-stripping Card, by Joseph Turner, Philadelphia.

No. 1687. Improvement on Danforth spinner, by do. do.

No. 1701. Gutta Percha belting and specimens from the American Gutta Percha Company, New York, by John Thornley.

No. 1705. Machine for weaving 3 ply Carpeting, by Jno. Nott, Phila.

No. 1706. " " " Ingrain Carpeting, " " "

Nos. 1728, 1729. Plated Fancy Registers, made by Culver & Tuttle, N. Y., deposited by B. M. Feltwell.

No. 1732. Cast Iron Hexagon Chimney Top, by B. M. Feltwell, Philadelphia.

No. 1773. Machine for making Ships treenails, by N. O. Mitchel, Gardiner, Maine.

No. 1552. A water close stool, by Evans & Watson.

No. 1535. 5 Hydraulic Rams by W. & B. Douglas, Middleton, Conn., deposited by Dilworth, Branson & Co.

No. 1600. 1 Hydraulic Ram Engine, do. do.

No. 1691. Hydraulic Ram, by P. Martin.

No. 1724. " " by Berkinbine & Martin.

No. 1925. " " " " "

No. 1730. Hydraulic Rams, Garchell's Patent, made and deposited by Allen Gawthrop, Chester county.

XI. *Stoves and Grates.*

The judges report that the collection in this department appears to be quite equal in extent and importance to any previously exhibited. The cook stoves embrace a great variety of patterns and are a source of much attraction to the housekeeping portion of the community. There does not, however, appear to be among them, any displaying such a degree of superiority over those heretofore exhibited as warrants the award of a first premium.

They make the following awards:

No. 1523. Three Nursery Stoves, made and deposited by Jackson & Morris, Philadelphia, neat, well made, and convenient,

A Second Premium.

Nos. 1512, 1513, 1514. Cook Stoves of Brooks's patent, (hot blast) made and deposited by North & Harrison, Philadelphia. Recommended for economy and convenience, to *A Second Preminm.*

No. 1587. Bath Boiler, made and deposited by H. Johnston, Philadelphia. Remarkably good workmanship, *A Second Premium.*

No. 1502. Four air tight Brick oven cook stoves;

No. 1503. One radiating parlor stove;

No. 1504. Six Cast-Iron, air tight, made by Johnson & Cox, Troy, N. Y., and deposited by Cox & Boughton, *A Second Premium.*

No. 1508. 3 Cook Stoves, made by F. W. Most, Philadelphia; excellent pattern. *A Third Premium.*

No. 1542. Double Oven Cook Stove, by J. Feinour, Philadelphia, simple and efficient *A Third Premium.*

No. 1552. Union range and air heater, by Prouty & Barratt, Philadelphia. *A Third Premium.*

Nos. 1621–4. Cook Stoves, by Warnick, Lybrand & Co., Philadelphia. *A Third Premium.*

No. 1682. Radiator Stove, by Foering & Co., Philadelphia. *A Third Premium.*

The judges notice the following with commendation.

No. 1540. Cook Stove of J. Kisterbock, Philadelphia, still maintains its good character for economy and durability, for which on a former occasion it has received a first premium.

No. 1631. A kitchen range by B. M. Feltwell, Philadelphia.

No. 1517. Bay State Cook Stove, Peck & Co., Springfield, Mass., deposited by Wm. Yard, Philadelphia.

No. 1595. Two similar Stoves, by Washington Harris, Philadelphia.

No. 1632. Improved Cook Stove, by Adam Ketler, Philadelphia.

No. 1678. 3 Parlor & Cook Stoves, by J. S. Clark, Philadelphia.

No. 1700 2 Cast Iron Radiators, by Weaver & Volkmar, Philadelphia, of good form and finish.

No. 1511. Epicure Cook Stove, by John Stewart, Philadelphia.

The furnaces for warming apartments are generally censured for faulty arrangement, in not allowing free access of fresh air in sufficient volume in order to prevent the over heating of the radiating surface.

The following may be exempted from this stricture.

Nos. 1534, 1630. Cast Iron Furnace of Culver's Patent, deposited by B. M. Feltwell.

No. 1546. Cast Iron Heater by G. W. ~~Walker~~, New York, deposited by R. S. R. Andrews.

No. 1589. Heater by G. Fox, New York, deposited by Peters & Co.

No. 1547. Model of Heater for heating houses by hot water, by R. S. R. Andrews, Philadelphia.

XII.—*Cabinet Ware.*

The judges complain of the paucity of the specimens of this branch of manufacture, in the Exhibition of this year, in comparison with the large amount of elegant and costly productions which make their appearance yearly in our city.

The judges report the following awards:

No. 962. Case of Bows and Arrows, made and deposited by Saurman & Magarahan, Philadelphia. For beauty and accuracy of workmanship, *A First Premium.*

No. 1214. Japanned Tables, made and deposited by Daniel D. Dick, Philadelphia. For their exceeding beauty, *A First Premium.*

No. 1221. Enamel Painting, by John Wilson, Philadelphia. For fine taste and beauty of execution, *A First Premium.*

No. 1297. Inlaid Tables, by Karstien & Smith, Philadelphia. For style, execution and finish, *A First Premium.*

No. 1236. Six Looking Glass and Picture Frames, by Wm. Johnson & Co., Philadelphia, *A Third Premium.*

No. 425. A lot of Glue, by Bodine, Baeder & Co., Philadelphia, *A Third Premium.*

The judges report commendatory notices of

No. 1201. A centre table, made by Wm J. Harrison, Philadelphia.

No. 1284. Extension writing desk, by John Smith, N. Y., deposited by B. D. Roberts.

The various lots of Venetian Blinds, received the encomiums of the judges.

No. 1296. Fancy work Box, by H. W. Hazzard, Philadelphia.

XIII.—*Musical Instruments.*

The square pianos, do not surpass those deposited in the last Exhibition.

The judges make the following awards.

No. 1235. Grand piano, made by J. Chickering, Boston, deposited by E. S. Walker. For great power, compass, and finish, combined with excellence of tone. *A First Premium.*

No. 1333. A case of reeds and pipes for organs, made by J. C. B. Stanbridge, Philadelphia. Fine tone and finish. *A First Premium.*

No. 1256. One Accordion, by Anthony Faas, Philadelphia. For improvements and ingenuity. *A Third Premium.*

The judges notice favorably,

No. 1264. Pianos, by C. Meyer, Philadelphia.

No. 1260. Pianos, by the Philadelphia Manufacturing Company, deposited by Joseph Lane.

XIV.—*Glassware.*

No. 690. Made and deposited by Hartell & Lancaster, Union Works, Kensington, Philadelphia. An extensive and beautiful display of colored glass, made in a bottle furnace from open pots, also mineral water bottles, carboys, druggists' glassware, and articles for the use of chemists. The mineral water bottles are very superior in the uniformity of thickness of the glass. The colored glass for perfumers, is fully equal to that exhibited last year, for which a first premium was awarded. In a communication from the manufacturers, they state that by improvements discovered and adopted, they are prepared to sell their goods at greatly reduced prices from the last year, a reduction in the price of production being a valuable result in the arts, they recommend

A Recall First Premium.

No. 1287. Stained window glass, made and deposited by Euston & Weer, Philadelphia. The judges are pleased to observe in accordance with a hope expressed by the judges at the last Exhibition, that there has been an improvement in this branch of the arts. In this collection many of the colors are brought out, the only failure is in the red, which may be due to the coloring material, and not the fault of the manufacturers, the design is tasteful, and artistical effect good. The judges recommend an award of *A Second Premium.*

No. 1329. Stained and ornamented window glass, made and deposited by John Gibson, Philadelphia. This collection embraces a limited variety in the art, but is deserving of praise for its artistical beauty.

The attention of the judges was called to some Druggists' jars containing drugs, deposited by Messrs. Powers & Weightman; the glass is very white and free from blemishes, but the jars are not so well made as is desirable.

No. 691. Toilette bottles, made and deposited by Thomas Hartell of Philadelphia, deposited as specimens of the first colored flint glass made in this country.

XV.—*Books and Stationery.*

No. 69. A case containing a copy of the last edition of Dr. Webster's Dictionary of the English language, in quarto form, designed as a present to the queen of England. This is a beautiful specimen of the perfection to which the manufacturing of books has been brought in this country, the design for illuminating the edges of the leaves, and the method of applying, are entirely new, and produce a fine effect. The workmanship throughout is of a very superior order, for this case and Nos. 39 and 69, made by J. B. Lippincott & Co., *A First Premium.*

No. 65. Lead pencils, made by A. G. Fay & Co., Concord, Mass., deposited by H. L. Lipman, are a very superior article, the lead is very fine, the color good, and manufactured in a first rate manner throughout. *A First Premium.*

No. 77. Straw boards, for Bookbinders and box makers, made by Shryock & Co., Philadelphia, an article of superior finish, and deserving especial notice from manufacturers. *A First Premium.*

No. 54. Brass Dies, &c., by W. M. Thompson, New York, used for ornamenting book covers, are superior specimens of the art, and entitled to *A First Premium.*

No. 11. Slates, made by R. M'Dowell & Co., Philadelphia, considered a very superior article, and entitled to *A First Premium.*

No. 82. Specimens of wood engravings, engraved by Croome, Philadelphia, printed by Griggs & Adams. The lines are very fine and distinctly brought out, without the usual over and underlaying. The effect of the light and shade is admirable, the Committee think the Messrs. Griggs & Adams have done themselves great credit. *A Third Premium.*

No. 52. Universal Atlas in folio, a most beautiful specimen of the art of transferring and lithographic printing, from the press of P. S. Duval, Philadelphia, transferred by Bourquin. *A Third Premium.*

The judges make favorable mention of

No. 56. Two large maps of Pennsylvania, printed and colored by R. L. Barnes, Philadelphia.

No. 15. Blank books, by W. H. Maurice, Philadelphia, a very good specimen of work, particularly in the ruling, which the Committee consider superior in accuracy and evenness of color.

No. 22. Blank books, by Adams & Brothers.

No. 66. Improved movable binder, for the temporary binding of letters, invoices, &c., by Wm. Mann of Washington, D. C., deposited by maker, an article of great convenience to business men.

No. 67. Newspaper files, by the same, upon the same principle.

XVI.—*Fine Arts.*

The judges have the satisfaction of reporting a favorable change in this department of the exhibition. The daguerreotypes have reached a high degree of perfection, and the specimens of printing in colors are greatly commended.

They report the following awards:

No. 1211. Lithographic printing in colors, by A. Britt, Philadelphia. *A First Premium.*

No. 1267. Lithographic Printing in colors, by Thos. Sinclair, Philadelphia. *A First Premium.*

No. 628. Chasings on metal, by E. Wagner, Philadelphia, excellent in execution and chaste and beautiful in design. *A First Premium.*

No. 1338. Daguerreotype portraits by M. A. Root, Philadelphia. *A First Premium.*

No. 1399. Daguerreotype portraits by M. P. Simons. *A First Premium.*

No. 1240. Daguerreotype views of Cincinnati, by Fontayne & Porter, Cincinnati, Ohio. *A First Premium.*

No. 1292. Daguerreotype portraits, by England & Gunn, Philadelphia. *A Second Premium.*

No. 1209. Daguerreotype portraits. by M'Clees & Germon, Philadelphia. *A Third Premium.*

No. 1307. Vase with carving in ivory, by Andrew Wurfflein, Philadelphia. *A First Premium.*

No. 1220. Transfers from steel and copper to stone, by Frederick Bourquin, Philadelphia. *A First Premium.*

No. 1230. Landscape in oil, by P. Weaver, Philadelphia. *A Second Premium.*

No. 1276. Specimens of penmanship, by Jas. Hallowell, jr., Philadelphia. *A Third Premium.*

They notice favorably,

No. 1233. Drawings by pupils of G. R. Holmes.

XVII.—*Jewelry and Silver Ware.*

The judges regret that the display this season is much smaller than usual.

They make the following awards.

No. 641 & 682. Cases of silver ware by Wm. Wilson, Philadelphia, fully sustain the reputation of the manufacturer. *A First Premium.*

No. 684. Silver Pencils and Gold Pens, by M. S. Fife, Philadelphia. *Referred to Committee on Science and Arts.*

They make favorable reports of

No. 654. A case of silver pencils and gold pens by J. J. Hatcher, Philadelphia.

No. 643. A glass show case, by W. S. Peters, Philadelphia.

XVIII.—*Marble and Statuary.*

The judges make the following award.

No. 1318. Specimens of composition marble, by Thos. W. Dufrene, Philadelphia. Beautiful imitation of marbles. *A First Premium.*

They notice favorably,

Nos. 1680 & 1681. A marble Egyptian enclosure and lamb, and marble posts, by H. S. Tarr, Philadelphia.

No. 1306. A marble urn, from a design by Hoxie & Button, by Henry S. Tarr, Philadelphia.

XIX.—*Hats and Caps.*

The judges notice a general improvement in this branch of manufacture, especially in the article of silk hats, which will favorably compare with the Parisian. They have to regret, however, the disappearance of the products of our larger fashionable establishments.

They report the following awards:

No. 945. Moleskin hat, made and deposited by Wm. Hudson, Philadelphia, a lad of 16 years of age. A perfect specimen of a hat. *A First Premium.*

No. 927. Caps, made by Messrs. Elfelt, Brothers, Philadelphia. *A Third Premium.*

No. 966. A case of silk hats, by Samuel Hudson, Philadelphia. *A Third Premium.*

No. 999. Silk hats, by Geo. G. Getz, Philadelphia. *A Third Premium.*

They notice favorably,

No. 915. A case of caps, by P. Erhard, Philadelphia.

No. 958. A case of hats, by Joshua Bower, Philadelphia.

No. 963. Beaver and Neutria hats, by Benj. Lightfoot, Philadelphia.

No. 995. Hats, deposited by F. & J. D. Campbell, Philadelphia.

No. 1000. A case of hats, by E. S. Williams, Philadelphia.

XX.—*Furs.*

No. 1012. A case of Russia sable, stone, martin, chinchilla, muffs and boas, made and deposited by G. F. Womrath, Philadelphia. The furs are all very fine quality, most excellent dressing, well stuffed, the style of trimming, as well as general finish, are very superior, they have all been well matched, but we would suggest to the maker, that in so fine an article as the Russia sable muff, valued at three hundred dollars, more of the head and neck might have been trimmed off to advantage. For the great superiority of this lot, we award *A First Premium.*

No. 944. A case of Hudson's Bay martin, natural lynx, fitch muffs and boas, mostly good skins and well dressed, the skins, however, have too much left of the head and neck, the stuffing of the muffs is inferior, and the matching is not as good as it ought to be, for the fine quality of the fur; to the makers, Solis & Brothers, 86 Arch Street, we award *The Third Premium.*

XXI.—*Combs and Brushes.*

The judges report that no combs were offered for their consideration, and but two cases of brushes.

They make the following award:

No. 1037. Case of brushes, by Messrs. Abel & Bicknell, Philadelphia, chaste and beautiful in design, and superior in workmanship. The ivory handle tooth brushes, and bone handle hair brushes, are believed to be the first of the kind manufactured in the country, in quantities. *A First Premium.*

XXII.—*Coach Work.*

No. 1768. New axle, by Chinnock & Co., New York, the invention consists of a small ball which rolls in a groove made in the axle. It is we believe new, and

Refer it to the Committee on Science and the Arts.

No. 1626. A tilbury, made by W. D. Rogers, Philadelphia, a handsome new style of finish and good workmanship. *A First Premium.*

No. 1577. Brewer's dray, by B. Flum, Philadelphia, substantial and well built, new style, of good material and workmanship, we award *A First Premium.*

No. 1742. An omnibus, by J. Stephenson, New York, good style and excellent workmanship, which does great credit to the workmen, we award *A First Premium.*

No. 1694. A hose carriage, by G. W. Watson, Philadelphia, of fine style and superior workmanship. *A First Premium.*

No. 1673. A sulkey, by Chas. Scattergood, Philadelphia, creditable specimen of work. *A Third Premium.*

No. 1590. A porter's dray, by Wm. Snyder, Philadelphia, heavy and strong, excellent material and workmanship, equal to any heretofore exhibited.

XXIII.—*Leather.*

The finest display ever offered at the exhibition, in quantity and variety as well as quality and finish.

The judges make the following awards:

No. 347. One dozen calf skins, deposited by H. M. Crawford, Philadelphia. A very superior article. *A First Premium.*

No. 362. A lot of sole leather, made and deposited by C. B. Williams, Philadelphia. *A First Premium.*

No. 331. One dozen calf skins, deposited by Thos. Mogridge, Philadelphia. *A Second Premium.*

No. 368. One dozen russet calf skins, and a lot of skirting, deposited by Wm. Forepaugh, Philadelphia. *A Second Premium.*

No. 284. Two rolls of shoe skirting, made and deposited by Thos. Naulty, Philadelphia. *A Second Premium.*

No. 394. Seven sides russet leather, by H. Davis, Philadelphia. *A Second Premium.*

No. 390. Two rolls of shoe skirting, made and deposited by R. Hutchinson, Philadelphia. *A Third Premium.*

No. 348. The specimen of enameled chaise leather, made and deposited by the Messrs. Wards of Newark, N. J., the judges believe to be the largest hide ever exhibited, and the quality in connexion with its size, they think, will compete with any ever manufactured. The specimens of colored leather of various kinds, by the same, are equally creditable, and are a happy illustration of the progress of American manufactures. For the general excellence of their deposit, the committee, in accordance with the report of the judges, recommend to the Institute the award of a gold medal.

No. 385. Two sides band leather, by E. Middleton, Crosswicks, New Jersey. *A Third Premium.*

They make favorable mention of the following:

No. 315. Six sides of shoe skirting and enameled leather, by John Riehle & Co., Philadelphia.

No. 339. One dozen thong leather, by A. Briggs & Co., Winchester, Ct., deposited by Jno. H. Chambers & Co., Philadelphia.

No. 361. A lot of sole leather, by W. H. Crawford, Philadelphia.

XXIV.—*Morocco.*

The remarks on leather are entirely applicable to the display of morocco.

No. 336. Morocco by Taylor & Eveland, Philadelphia. One dozen Patna dyed kid, very good. One dozen Tampico French black dyed superior leather, and remarkable finish, worthy of *A First Premium.*

No. 319. A lot of Tampico, French and glazed morocco, by C. J. Shorday, Philadelphia, superior in color to any leather, very good, and worthy of *A First Premium.*

No. 366. A lot of Turkey finish morocco, by Adam Smith, of Philadelphia, of different colors, for bookbinders, a superior article, worthy of *A First Premium.*

No. 353. One dozen Tampico French morocco; one dozen Madras French; one dozen Tampico brush, all black, good leather and well finished. Two dozen black glazed and brush kid, the leather first rate, colored and finished in a superior manner; made and deposited by G. S. Adler, Philadelphia, entitled to *A First Premium.*

No. 388. One dozen Tampico French dyed black color, very good and finish the same. One lot of bronzed French morocco, same as the above, made and deposited by Middleton & Co., Crosswicks, N. J., and which we award *A Second Premium.*

XXV.—*Boots and Shoes.*

The judges on boots and shoes report as follows:

No. 324. One case fine boots and shoes, made and deposited by Jno. Heumann, Philadelphia, good articles similar to those exhibited previously.

XXVI.—*Chemicals.*

The judges take pleasure in reporting that the display of Chemicals this season is greatly superior to that of any previous occasion.

They make the following awards:

No. 402. A magnificent display of Chemicals by Messrs. Powers & Weightman, Philadelphia, late Farr, Powers & Weightman. They enumerate as particularly deserving of notice, the Sulphate of Quinine and Morphine, Arseniate and Citrate of Quinine, Tartar emetic, Piperine, Red precipitate, Nitrate of Silver and Santonine, which is here exhibited for the first time; the large specimens of Alum, are of superior whiteness and beauty of crystallization. The chemicals of these gentlemen, are superior to those of last year. The committee recommend to the Institute to award *A Recall Gold Medal.*

No. 351. Chemicals, by Smith & Hodgson, Philadelphia. The specimens of acids, Chloroform, Syrup of Iodide of Iron, Extract of Krameria,

Valerianate of Zinc, Chromic Acid, Oxide of Chrome, and Bicarbonate of Soda in lumps, are particularly noticed.

A Recall First Premium.

No. 395. Mineral water, by E. Roussel, Philadelphia.

A Recall First Premium.

No. 321. Specimens of Metallic Iron, by William Proctor, Philadelphia. For superior purity and make, *A First Premium.*

No. 312. Chemicals, by Chas. Ellis, Philadelphia. The oils of Cubebs and Copaiva, Citrate and Acetate of Iron, Citrate of Quinine, Extract of Krameria, and Tannin, are noticed. *A Second Premium.*

Nos. 396–7. A case of 200 specimens of Materia Medica, and various chemical preparations, by Edward Parrish, Philadelphia. The former are arranged for medical students, and the style in which they are got up is very creditable. Among the latter are noticed, the Citrate of Magnesia, a pleasant purgative, and the Solution of Gun Cotton in Ether.

A Second Premium.

No. 328. Black Lead Crucibles, from Phœnix works, Taunton, Mass., deposited by Cresson, Fisher & Co., *A Second Premium.*

No. 340. Black Lead Crucibles, by J. W. Ingell, Taunton, Mass.,

A Second Premium.

No. 329. Powdered Drugs, by Haskel & Merrick, N. Y., deposited by Thomas S. Wiegand, *A Second Premium.*

No. 327. Blacking, (Liquid) by W. Curry, Philadelphia,

A Second Premium.

No. 375. Polishing paste for Silver Ware, by Howell & Read, Philadelphia, *A Third Premium.*

No. 380. Mineral water, by A. McFarland, Philadelphia,

A Third Premium.

They notice with commendation,

No. 341. Prussiate of Potash, by H. W. Worthington, Philadelphia. A fine display: sustains the reputation of the maker.

No. 318. Magnesia in bottles, by G. Bley, jr., Philadelphia.

No. 309. Case of Chemicals, deposited by Linn, Smith & Morgan, Philadelphia.

No. 317. Chemicals, by H. M. Troth, Philadelphia. The Iodides of lead and mercury are particularly noticed.

No. 401. Nitrate of Ammonia, by Geo. Canby, Philadelphia.

No. 301. Disinfecting Fluid, by Dr. Feuchwanger, New York.

No. 325. Two boxes of Starch, by S. F. & G. W. Stratton, Philad.

No. 314. American Mustard, by Fell & Brother, Philadelphia.

No. 360. Ground Spices, by C. Hutchinson, Philadelphia.

XXVII.—*Philosophical Apparatus.*

The philosophical apparatus, brought under the consideration of the judges, is greater in amount and higher in character, than has been exhibited, for several years.

The judges make the following awards:

No. 602. Model of a Hydrostatic Press;
No. 686. Magneto-Electrical Machine;
No. 1627. Model of a Steam Engine,
} made by L. C. Francis, Philadelphia.

For excellence, skill, and workmanship, *A First Premium.*

No. 646. Case of Philosophical apparatus, by T. J. Weygandt, Philadelphia. This case contains a very delicate Thermo-multiplier, and a new pole changer, which do great credit to the artist. For ingenuity, skill, and workmanship, *A First Premium.*

No. 652. Balance for weighing silver coin, made for the chief coiner of U. S. Mint, by Jos. Canby, Philadelphia. The workmanship displayed is of a very high order. *A First Premium.*

No. 658. Scales, Weights and Measures, by F. Meyer & Co., Philadelphia, sustain the artist's reputation; *A Recall First Premium.*

No. 632. Chromatrope by H. S. Nolens, Philadelphia, neatly and delicately painted, *A Second Premium.*

Nos. 674 and 681. Chase's double acting magnetic machines, by A. F. Porter, Philadelphia, *A Second Premium.*

No. 673. Case of Electro-magnetic apparatus, by G. W. Risdon, Philadelphia, *A Third Premium.*

No. 616. Electrical machine, by G. Boshart, Philadelphia, *A Third Premium.*

No. 659. Voting Machine, by F. C. Goffin, Trenton, N. J. *Referred to the Committee on Science and the Arts.*

No. 695. Legislative Telegraph, (vox populi) by R. E. Monaghan, Chester county, Pa. *Referred to the Committee on Science and Arts.*

No. 1286. Patent universal joint, by Wm. Wurdeman, Washington, D. C. *Referred to the Committee on Science and Arts.*

They favorably notice the following:

No. 634. Magneto-electrical machine, } by J. P. Stratton, Philadel-
No. 635. Electro-magnetic machines, } phia.
No. 640. Case of Electro-magnetic machines, by C. & J. Neff, Phila.
No. 671. " " " " by W. H. Pile, "

XXVIII.—*Straw Goods.*

The judges notice an improvement of this part of the Exhibition, and trust that they may have greater cause for the same remark in future, as there are several thousand persons employed in this city in this branch of manufacture.

No. 1029. Bonnets, made and deposited by Thos. White, Philadel phia, straw bonnets made of English split, patent, and luton plait, are perfect in shape, and the bleaching and pressing deserve much praise.

Also six chapeaux "pamela," these bonnets are made entirely of American stock, the braid being plaited, and the bonnet manufactured in the establishment of the depositor; they are of great purity of color, and in shape as well as the presswork, meet the commendation of the Committee; the six pieces of the plait deposited with them, evince much care in the braiding, for the six chapeaux pamela, we award the *First Premium.*

No. 970. Chapeaux pamelas, made and deposited by Mrs. Susan Kendall, New York, for the making only; these bonnets fully sustain their great beauty in color and finish, for which your Committee recommended a premium last year.

No. 1035. An infant's summer hat, made of corn husk, by the pupils of the Orphan Asylum at Natchez, Miss., deposited by J. R. Lambdin,

Philadelphia, the material being plaited and then sewed in the proper shape. In consideration of the ingenuity displayed by the juvenile makers, it also bringing a waste material into profitable use; we award the *Third Premium.*

We beg leave to call the attention of straw manufacturers to the husk of the Indian corn, as an abundant and cheap material which we have no doubt will be found suitable for summer wear, for the youth of both sexes; twisted and plaited it would closely resemble the panama hats, and no doubt could be produced at a much less cost, besides that its value would entirely consist in the labor of females.

XXIX.—*Surgical Instruments.*

The judges report that the number of articles in this branch deposited in time for competition, was small, and few of them exhibit sufficient improvement over those displayed in former Exhibitions, to merit notice.

They make the following awards:

No. 678. A case of teeth, by Jones, White & Co., Philadelphia, are remarkable for their beauty of finish, and worthy of *A Second Premium.*

No. 669. Dentists' work, by C. S. Beck, Philadelphia, with a new application of the principle of atmospheric pressure, to retaining teeth in their proper place, very neat and well finished. *A Third Premium.*

They notice favorably,

No. 710. A model of an artificial leg, by B. F. Palmer, Merdith, N. H., displays great ingenuity in its construction, is well finished, and seems admirably adapted to the purposes for which it is intended. The judges, however, not having had an opportunity of witnessing a full sized limb constructed after this model, in operation on the living subject, must decline giving a positive opinion as to its practical merits. They do this with the less hesitation, since the merits of the invention are at present undergoing investigation before the Committee on Science, and the Arts of the Institute.

No. 727. An artificial leg, by F. O. Deschamps, Philadelphia, *Referred to the Committee on Science and Arts.*

XXX.—*Perfumery.*

In accordance with the report of the judges, the Committee make the following awards:

No. 333. Made and deposited by H. P. & W. C. Taylor, is particularly characterized by the large amount and excellent quality of the transparent soap, for which the manufacturer has been celebrated during many years. The Committee notice as novel and beautiful the transparent red soap of this lot, is entitled to *A First Premium.*

No. 346. Perfumery and soaps, made and deposited by E. Roussel & Co., Philadelphia, being the finest display in the Exhibition, as an improvement over preceding Exhibitions, the Committee think entitled to *The Recall First Premium.*

No. 948. A large lot of excellent snuff and chewing tobacco, by W. A. Appleby, Philadelphia, for the general superiority, *A Second Premium.*

No. 305. Large mass of palm soap, by G. R. Graves, West Chester, Pa., is very creditable in color and solidity, and it reflects credit on the manufacturer, for the palm soap he is awarded

The Third Premium.

They mention favorably,

No. 332. Soaps and perfumery, by Thos. Worsley, Philadelphia.

XXXI.—*Gum Elastic Goods.*

The Committee make the following awards:

No. 392. Gum elastic boots and shoes, by John Thornley, Philadelphia, of superior quality, and fully sustaining the reputation of the manufacturer. A new style of ornamenting in imitation of embroidery, is noticed as a pleasing novelty. *A First Premium*

No. 1580. India Rubber car springs, made by F. M. Ray, New York city, deposited by G. Whitney, N. Y.; exhibited for the first time, and being a new application of India Rubber, is

Referred to the Committee on Science and Arts.

XXXII.—*Copper, Brass, and Plumbers' work.*

The following award is reported by the Committee.

No. 1596. Three pieces refined ingot copper, by the Boston and Pittsburgh Mining Company, and deposited by Earps & Young, Philadelphia. The ore is from Lake Superior, it is very fine copper, and for care in smelting and refining, *A First Premium.*

No. 1690. Section of leading hose, by G. & W. Dialogue, Philadelphia, is favorably noticed. Also,

No. 1695. Large bell, by T. T. Dyer, Jr., Philadelphia, weighing 3675 lbs., a very good casting, but the volume of sound cannot be judged of correctly until the bell is suspended.

XXXIII.—*Tin Work.*

No. 1541. Case of tin toys, made and deposited by Francis, Field & Francis. Well made, and a good substitute for the German wooden toys, being stronger.

No. 1575. Tea canisters, by J. Hall Rohrman, Phila. Creditable articles.

No. 1674. Tin and japan ware, by W. Gilbert, Philadelphia. We notice with pleasure a great improvement over those exhibited last year by the same. *A Third Premium.*

No. 1633. Tin and japanned ware, by Isaac S. Williams & Co., Phila. The articles fully sustain the reputation of the manufacturers, for which a first premium was recommended last year by the judges: but as Mr. Williams is a member of the Board of Managers, no award could be given.

XXXIV.—*Paints and Colors.*

No. 302. Paints, made and deposited by Charles Hasse, Philadelphia, consisting of chrome yellow, Prussian blue, Fr. green, rose, pink, and wet lake. All excellent in quality, equal to the imported.

No. 310. One lot white lead, made and deposited by R. & J. Wharton, Philadelphia. Excellent in quality and soft in texture.

No. 398. A lot of white lead, by Wetherill & Bro. Also excellent in quality.

No. 364. Lot of water colors, by G. W. Osborne. Has every evidence of their former reputation.

No. 307 and 320. Lots of lamp black. Both excellent qualities.

No. 307. By Thomas Matlack, Philadelphia.

No. 320. By Thomas P. Wilson, Philadelphia.

No. 349. Six samples varnishes, by B. C. Horner, Philadelphia, From the color, consistency and clearness, the Committee think well of them, but to test them properly, it would require time to prove their durability.

No. 402. Vermillion, by Powers & Weightman, Philadelphia, is the nearest in tint to the Chinese, but not as strong in body.

XXXV.—*Fancy Goods.*

The Committee make the following awards:

No. 947. Eight cases prepared birds, by James Taylor, Philadelphia. For the beauty, variety of collection and execution of the work, *A First Premium.*

No. 994. Patent elastic swing, by John T. Townsend, Philadelphia. For its beauty and safety, and adaptation to the purposes of exercise, *A Second Premium.*

No. 920. Case of morocco goods, by Fry & Jones, Philadelphia. For ingenuity and workmanship, *A Second Premium.*

No. 916. One frame hair work, by Trautman Grob, Boston, deposited by Horace Logo, Philadelphia. The perspective of this piece is very good. *A Third Premium.*

No. 959. One frame shell work, by Mr. Lowber, Newark, N. J. For beauty of the collection and workmanship, *A Third Premium.*

No. 980. A box of shell work, by H. M. Chapman, Philadelphia. *A Third Premium.*

The following are favorably noticed:

No. 908. A collection of feathers, dyed and cleansed in this city, by Mrs. A. Griffiths.

No. 921. A case of lamp shades, by F. Quarre, Philadelphia. Very rich designs.

No. 933. A collection of mosses, from Nahant, by H. Basset, Nahant, deposited by J. Kite.

No. 941. A case of gloves, by G. R. Curry, Philadelphia. Have received a premium at a former exhibition.

XXXVI.—*Housekeeping Articles.*

The judges recommend the following awards:

No. 1619. Niagara shower bath, by Ephraim Larrabee, Baltimore, Maryland, which they pronounce perfect in all parts. May be used in all locations. *A Second Preimum.*

No. 1321. Patent spring bed, by P. O'Neill, Philadelphia.
A First Premium.

No. 1335. A patent spring mattrass, by E. Foliot, Philadelphia.
A First Premium.

No. 1280. An atmospheric spiral churn, by E. Spain, Philadelphia. On examination they consider this construction superior to any exhibited, and easily purified. Entitled to *A Third Premium.*

They notice favorably,

No. 1570. A refrigerator, by David Evans, jr., Philadelphia. They approve of the internal arrangements, and believe the slate lining and water-cock a decided improvement.

No. 1634. Refrigerator, by Nath. Waterman, Boston, deposited by D. R. Murphy. The ventilator a decided improvement, especially when lined with zinc, which requires more air.

No. 1606. Cast iron bath tub, by Savery & Co., decidedly preferable to those made of wood.

No. 1268. Door mats, made and deposited by Barnes & McKeachnie, New York. A very superior article worthy of the attention of the public, and greatly preferable to any before in use.

N. 1226. Brooms and brushes, made by John Shipman, Massachusetts, deposited by W. C. Allen. Well made and neatly finished.

No. 1222. A forcing-pump shower bath, made and deposited by Ellis L. Davis, Philadelphia.

No. 1551. Cracked wheat, by Caleb Clothier.

No. 1213. Bread, made without fermentation, by J. Moxey, Philadelphia. They pronounce it to be excellent.

No. 607. Weather strip, made by E. C. Matthewson, Hartford, Ct., deposited by Thos. Judd, Geneva, N. Y. An improvement worthy of attention.

No. 1334. Willow ware, by Chas. Askam, Philadelphia.

No. 1305. Hobby horses, by R. H. Ollson, N. Y., deposited by J. J. Taylor, Philadelphia.

No. 1225. Waffle Irons, by A. Jones, Philadelphia. A marked improvement upon the former invention, as it may be conveniently used over a coal fire.

No. 1563. Flour, made by Leech & Sons, Leechburg, Pa., deposited by A. Wright & Nephew. The best exhibited.

No. 1548. Flour, made by John Williams, Rochester, N. Y., deposited by Caleb Clothier.

No. 1550. Flour, made by Philip Garbutt, Wheatland Mills, Genesee, N. Y., deposited by Caleb Clothier.

XXXVII.—*Clothing and Needle Work.*

The Judges report, that although the display in this department of the Exhibition, is not so extensive as on some former occasions, there is still a very creditable collection. A manifest improvement in the patterns and execution of many specimens, is noticed with pleasure.

They make the following awards.

No. 904. Odd Fellows' regalia, by Curtis & Norcross, Philadelphia, elegant in design, and beautiful in embroidery. *A Second Premium.*

No. 964. Three cases of Odd Fellows' regalia, by Granville Stokes, Philadelphia, elegant in workmanship. *A Third Premium.*

No. 981. Frame of worsted work, by Mrs. Wickersham, Philadelphia, beautiful and elaborate. *A Second Premium.*

No. 911. Embroidered sofa seat, by Miss E. Berg, Trenton, N. J., a beautiful piece of raised worsted work. *A Third Premium.*

No. 924. Cotton bureau cover, by Mrs. M'Cannon, Philadelphia, the best specimen of knitted work in the Exhibition. *A Second Premium.*

No. 923. Knit shawl, by Miss Mary Sharp, Philadelphia, beautiful work. *A Third Premium.*

No. 937. Lot of clothing, deposited by Bennet & Co., Philadelphia. *A Third Premium.*

No. 952. Case of children's clothing, by H. G. Suplee, Philadelphia. *A Third Premium.*

No. 968. Bed quilt, by Mrs. Evans, Gettysburg, Pa. *A Third Premium.*

No. 969. Tufted quilt, by Mrs. D. D. Durborow, Chambersburg, Pa., beautiful in design, and neat in workmanship. *A Third Premium.*

No. 1013. Case of bead work, by Mrs. Moore, Philadelphia. *A Third Premium.*

They notice favorably,

No. 1046. Beautiful quilt, by Mrs. Conrad Meyer, Philadelphia.

No. 1014. French plaiting, by Mad. Juery, Philadelphia, equal to any exhibited in former years.

No. 906. Three pairs of window curtains, by Miss E. Williamson, Philadelphia.

No. 909. One case of fancy articles, by Mrs. Ann Boyce, Philadelphia.

XXXVIII.—*Ship Chandlery.*

The judges make the following award.

Nos. 1713-4-5-6. Steering wheel, block, and hearts, by Naglee & Deklyne, for neatness of manufacture, *A Second Premium.*

XXXIX.—*Agricultural Implements.*

The judges report a much smaller number than at any preceding Exhibition.

They make the following awards.

No. 1525. A grain fan, made and deposited by John Bamborough, Lancaster City. *A First Premium.*

No. 1524. A corn sheller, separater, and cleaner, made and deposited by A. H. Stevens, Geneva, N. Y. *A First Premium.*

No. 1601. Stalk cutter, by Samuel Ware, Kensington, Philadelphia. *A Third Premium.*

No. 1719. Fitzgerald's patent portable mill, by C. Ross, New York, deposited by Chas. Greene. *A Third Premium.*

They notice favorably,

Various agricultural implements, deposited by Messrs. Prouty & Chandler, and Lewis & Johnson's patent atmospheric churn, deposited by Messrs. B. R. Springstien & Co.

Address delivered at the close of the Eighteenth Exhibition of American Manufactures, held by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, October, 1848. By the Hon. Joseph R. Ingersoll, Esq.

No department of useful improvement can be expected to prosper without public encouragement. The tardy progress of unassisted individual industry and skill, however well directed and unwearied, can with difficulty withstand surrounding rivalship, even when it has been fortunate enough to force itself into neighbouring notice and to excite limited and occasional reward. Of all the branches of mechanic art, there is scarcely one, some of whose developments have not sprung from comparative obscurity. Practical workings among elemental matter, by hands that do the humblest offices of preparation, suggest facilities which could scarcely occur to the theorist, however intelligent. The eye beholding a finished performance, well adjusted in all its parts, sees nothing of the painful and prolonged exertions, the minute and almost insensible degrees by which the result has been attained. Yet these are rich sources of combination and analysis, and combination and analysis are the only additions which genius and experience can contribute to the voluntary and liberal productions which are scattered abroad by nature with a generous hand.

Pecuniary returns are necessary objects of mechanical pursuit. But they are not the only or the principal inducements to honest industry. In its cherished prospect shines the clear light of Fame; and many an obscure intellect is brightened into glorious capacity by reflections from the enduring names of Watt and Arkwright and Fulton, once humble as its own, but now belonging to the acknowledged benefactors of mankind. Associations such as this can alone furnish opportunities for early distinction. They combine intelligence, experience, scientific knowledge, practical skill, and (haply) wealth. They draw forth from obscurity native merit and bring it into comparison with merit of its kind. If it bear the touchstone and prove of current worth, they cheer it on to redoubled energy, and leave it only when, secure in the possession of inherent and acquired strength, it can defy the bickerings of disappointed envy, and triumph in approved success.

These are in a word the objects of an Institution which in asking attention to every thing around us, performs a leading duty of its organization, and invites by a direct appeal to the senses, assistance from a well judging community. This is its proud display, its accomplishment —which yearly crowns a long career of modest and retiring efforts. Meetings monthly held with access to two thousand members, for mutual improvement; a library of gradual but certain growth; cabinets of objects for instruction; lectures connected with the Mechanic arts, natural Philosophy, and Chemistry, open not only to immediate members, but to alumni of distinguished seminaries, the University of Pennsylvania and the High School of Philadelphia; and a monthly journal replete

with varied matter to instruct and guide, now attaining its 275th number; these are preliminaries to an annual exhibition, the Eighteenth being now before us in all its admirable arrangement and teeming usefulness.

The Franklin Institute, if not the earliest association for the popular diffusion of science in its application to Mechanism, was the first to establish these periodical exhibitions of American Manufactures. An example so full of advantages to the mechanical community, has long been followed in the populous and older cities of the Atlantic border. It has now spread far into the interior. The city of Chicago, numbering twenty thousand inhabitants, after an existence as a town of some sixteen years, is about to make its second effort of a similar character. Were the practice which is so well established possessed of no other claims to merit, it would serve to collect and record from year to year authentic proofs of the progress of improvement. Of our own it may be said, that each succeeding effort, in some respects, outruns its predecessor; and each new increase in novelty and advancement, is greater, in comparison than the last. The practice serves, besides, to invite public attention; to stir up languid interest; to show what is possible by producing what is done; to stimulate exertion; to reward enterprise and industry; to prevent error; to fix a just estimate on the manifold productions of mechanic skill and bring it into notice; and to unfold the principles and the power of labor.

In the present display, there is distinguished merit. Particular excellences have been officially announced and will be duly appreciated. On an occasion when much is presented in individual branches for applause, a casual observer might be struck with the absence of others in which our manufacturers are known to excel. It is matter not less worthy of remark, that these spacious halls would readily accommodate far more numerous specimens of skill than are now contributed. A temporary building, erected for a similar exhibition in Paris in the *Champs Elysées*, has received the offerings of more than four thousand manufacturers. Perhaps patriotic artizans among us are disposed to impute to the public a lack of interest in the labors of the Institute. If a small proportion of the spirit which distinguishes any one of those sources which have been enumerated of its vital existence, those ingredients of a consistent and harmonious union, were manifested on each returning anniversary by a general indulgence of laudable and pleasing curiosity, the regret lately expressed by a distinguished foreigner, now happily identified with the science of the country, might soon cease to have support. He was surprised to find the total want of extensive Museums amongst us: those mute but expressive and eloquent teachers of otherwise inscrutable lessons of philosophy. Let public liberality contribute what would supply this valuable addition to the machinery wielded for public good by the Franklin Institute, and infinite zest will be infused into the ardor with which its immediate laborers are already animated.

There is no species of talent, no form of available and meritorious exertion, that is not at some stage of advancement, confirmed in its hopes and strengthened in its assurance by the favor of an enlightened public. Of all descriptions of merit, none more clearly exhibits or more honestly

deserves whatever encouragement it can receive, than that which is founded in mechanic skill. Its exercises and illustrations are altogether so practical, that there is scarcely room for deception in theory. The use and application are so general, and so familiar to every one, that it is almost impossible that any one should be misled by what in other branches of employment would be called empiricism or quackery. If error chance to find its way into a single quarter, truth with its disinfecting properties is distributed among a thousand and a thousand hands. Whatever sagacity may lie at the root of mechanic skill, how patient soever may have been the exertions by which it has arrived at excellence, it is for the most part applied to the ordinary purposes of life, is transparent in its exercise, and places infallible tests of failure or success within the reach of the commonest observation. When philosophy shall have done all it can for mechanism, it will find itself repaid by the moral lesson taught in return by mechanism, that power acting directly and without circumvention will produce the greatest effect. Different reasons concur in giving truth and importance to these suggestions among ourselves. No separate class exists among us aloof from the necessities of some description of toil, and from direct personal acquaintance with the fruits of industry. It has been the pride too of our countrymen to give practical efficacy not only to their own inventions, but to those of foreign birth, which coming into sickly and abortive life elsewhere, have remained for the want of a keener perception and more practical adroitness, objects of unprofitable labor or curious speculation, until both of the requisite deficiencies have been supplied. Possibly a more minute subdivision of labor, which has its unquestioned advantages abroad, may contribute to this result. Of the fact itself, one or two well known instances will suffice for proof. Our people are in the habit of turning their hands to any thing. Pioneers of the forest, the same axe wielded by the same arm fells the first tree, fashions the log into a wooden wall, cuts the tree into a boat, shapes the bean pole, and battles with the savage. Steam engines were long usefully employed for certain purposes in England. Captain Thomas Savery building upon still earlier discoveries, and especially those of Brancas, a modern Roman philosopher, obtained a patent for his invention in 1698, and it was applied to pumping water out of the Cornish mines and raising from them the ore. Newcomen improved the machinery in 1705; and Beighton simplified its movements in 1717. There it stood for half a century, when James Watt, a Scotchman, added great improvements, and it was brought, as is known to every body, into extensive use in mining, as well as for working in mechanical and manufacturing utility. But the effectual application of it to navigation was reserved for a Lancaster county mechanic. We have seen too the progress of the Magnetic Telegraph. Not its progress through space, for that defies the optics of thought itself, outstrips in rapidity the chariot of the sun, reaches a western destination while the hand of the dial goes backward without a miracle, performs its gigantic journeys according to every known means of computation in less than no time, and now, mainly by the experiments of one of the most accomplished associates of the Franklin

Institute, ascertains the longitude with almost unerring percision. By its wonderful influence, results of the recent election from various places, all of them hundreds of miles distant, were known in Philadelphia at an earlier moment than similar intelligence from the polls in the heart of the city. The progress of the discovery as a practical thing is the circumstance most worthy of notice. One of the Journals of the day quotes from Arthur Young's travels in France from 1787 to 1789 the description of "a remarkable discovery in electricity by M. Lomond." Wires connecting two cylindrical cases and electrometers, in apartments distant from each other, communicated signs or corresponding motions of a pith ball, from which the words were written down which they indicated; thus showing an alphabet of motions. The length of wires, it is added, makes no difference in the effect: "a correspondence might be carried on, at any distance; within or without a besieged town for instance; or for a purpose much more worthy and a thousand times more harmless between two towns prohibited or prevented from any better connexion." More than sixty years have elapsed since this imperfect instrument was made and thus described. But yesterday, its development has become the wonder of the world. What proportion of its adaptation to useful purposes belongs to ourselves especially, it is not necessary to ascertain. Much perhaps may be claimed by different intellects. European intelligence certainly laid a broad basis in the science of electro magnetism nearly thirty years ago, and in the subsequent discovery of the electro magnet. The use of an attractive power to write in legible characters is asserted to be an invention of our own. What will scepticism say in palliation of a doubt of the omnipresence of Deity when it finds that mortal enginery can vibrate responsive thought no matter how remote with a delay from its conception only sufficient to give it utterance? Distance increased in Arithmetical proportion is more than counteracted by additions to the series of galvanic pairs of plates which augment the magnetic power in geometric ratio.

The two inventions—the development of latent heat, which produced the steam engine, the modern lever of mechanical power, and especially of navigation by water and transportation by land,—and the development of galvanism, which produced the magnetic telegraph—seem to have been designed mainly for our country. A population spread over an immense extent, and migratory in habit and tendency, is enabled to hold immediate intercourse in one shape from the remotest distances, and personally to visit and become familiarly acquainted through the length and breadth of the land without loss of time, material expense or fatigue. The downward currents of impetuous rivers, that have no retiring ebb for thousands of miles, are stemmed and ascended with a certainty and speed, not to be commanded by other agencies, even on the surface of unresisting waters. A key to the great West, unlocks its mineral and agricultural stores, which in the absence of it, had remained for most purposes impenetrable mysteries. A new world expands in wealth and wisdom, over regions newly redeemed from the hunter and his game, and shares with more advanced civilization in distant regions, its own exhaustless and invaluable resources. In other countries, the

propelling power of steam is indeed of value, scarcely to be estimated,—here, it is indispensable. Every spot in the fertile valleys of the West, beckons its approach. Varieties of climate and soil are no longer the peculiarities of remote positions, but are brought together for the common good, as productions of the same parallels of latitude. Majestic distances are annihilated, or serve only to encourage moral elevation, without dividing local interests or preventing social and political harmony. Every additional step in the march of improvement, serves to render more obvious these peculiar advantages. The city of Chicago, at the extremity of Lake Michigan, is reached by the usual lake route from this place, in a journey of 1567 miles in six days. Works now in progress, the "Pennsylvania railroad," and the "Ohio and Pennsylvania railroad," will reduce the distance to 860 miles, or nearly one half, and will strike out more than half the time.

Other illustrations will be found scarcely less remarkable than those which have been adverted to. The tardy process of diffusing knowledge by copying manuscripts, was superseded centuries ago by the art of printing, which even in its imperfect state, was not inferior in importance to any discovery ever made. A press now in regular service at Leonardstown, Maryland, has been it seems in almost constant use for more than a hundred years. What resemblance in performance do these antiquated efforts bear to that rotary form of printing press, which is declared "to have produced on a trial experiment, twenty thousand copies per hour?" Anodynes have been used, at least from the days of Paracelsus, and probably as long as medicine has been a science. If relief from bodily suffering be the great secret of the healing art, how can mankind sufficiently appreciate for surgical and other purposes, the modern discovery of the inhalation of ether? We are told that it has circulated through the civilized world with greater rapidity than any other improvement of the day. (Patent office report.) And thus far we are assured upon the same authority, "the entire merit of originality and priority belongs to our countrymen"

An increasing desire to improve upon what we already enjoy—immediate and visible marks of the influences of improvement on an extensive theatre—and above all, substantial benefits derived from the practical character of our improvements—these are among the causes which will make our country the home of the mechanic arts. The realms to be occupied, and the work to be performed are disproportioned to the numbers who are to subdue the one, and to execute the other, according to ordinary rules of political economy. You overcome the difficulty by making a single machine perform the labor of five hundred hands. Undertakings, however great, cease to be formidable when your means are as gigantic as your object: boldly to attempt, seems alone necessary triumphantly to overcome. Adaptations in many respects belonging to ourselves, are in unison with inherent principles of art. Mechanism is the joint offspring of science and simple labor. We are proud enough to aim at the one, and not too proud to stoop to the other. Mighty efforts of genius have been employed in suggesting the elements, and determining the rules which must govern its operation,

while the mere docile hand of willing industry can put into practice the operations which are the fruits of them.

Having traced the commonest instruments of mechanic industry, from the uneducated, whose hands have given the last touch to the suggestions of brighter or more accomplished intelligences, back to those intelligences themselves, we shall have made but a portion of our journey in pursuit of truth. Beyond the proudest human intellects will be found a wiser and a holier teacher. Nature, the immediate offspring of the Parent of all good, instructs and teaches *them*. When a seaman finding a bale of goods too heavy for his strength, calls in the help of his familiar tackle, and then raises it with ease, he avails himself unconsciously of the philosophy of Vitruvius, who merely solved the problem of the agency of one of the half a dozen fundamental mechanical powers, which nature had under a different name, placed in his hands. She is the prolific source of all inventions. Reject her precepts, and genius and industry labor in vain. The quadrature of the circle, and the philosopher's stone, will probably be discovered only with the elixir of life: because they are all at variance with her essential laws; and perpetual motion must reconcile impossibilities, and reverse decrees as settled as the foundations of the earth, or it will remain an ignorant and abortive dream. Nature is as kind in her broad hints against working in the dark, as in pointing out true paths. Perhaps the pursuit of ingenuity, for example, in improving pneumatic engines, or those in which air is the agent of motion, might be diverted into more profitable channels, by the certainty that heat applied to the expansion of any gas, furnishes but a minimum of the power to be derived from similar applications to water or other liquids.

We talk of the pride of science. But science manifests wisdom and foreshadows success, when it assumes its humblest attitudes. To learn that we are unlearned, to see and appreciate the great extent of power that surrounds us, to feel how much of it is unattainable, and in humble hope to try to reach the lowest limits of its lofty sphere, and make a little segment of it our own, are genuine marks of merit, and just aspirings of devout ambition. Science is nothing more nor less than a knowledge of the works of nature, and the mode of making some of them available to purposes of human life. A development of her seeming mysteries is the utmost aim and end of scientific investigations the most profound. Philosophy in its abstruse and successful labors, can at last only hope to become acquainted with, and set in motion, the operation of her simple laws. The earliest and the latest lesson in the ample book of science, is inscribed by the finger of Nature. Her merest elements are full of wisdom: her sublimest efforts are not without simplicity. The inspiration of the brightest intellects, has been traced to what may be regarded as some of the most humble of her agencies. If a swallow's nest taught, according to the ancient architect, the art of thatching roofs with sprigs and loam; if a stagnant pool furnished philosophy with the element of artificial light; if the wet string of a kite unfolded the phenomena of electricity; and if fruit falling from the tree demonstrated the agency which keeps in place and motion the universe,—what undiscovered

secret may not yet reward a watchful scrutiny of Nature's familiar works? If minds partaking so largely of celestial mould were *thus* inspired, more limited intelligences may be content to bow their heads, and derive instruction from the same unerring source. Words wiser than the examples of philosophy refer us, if we would be also wise, to the lowly example of the humblest creeping thing, that having "no guide, governor or ruler," "prepareth her meat in the summer, and gathereth her food in harvest." Yet wisdom when even thus humbly taught, as we learn from the same inspired teacher, is "more precious than pearls: all things that thou canst desire are not to be compared to it,"—for "by wisdom is laid the foundation of the earth."

The pride of philosophy must be contented to stoop still lower. Nature herself, pure and uncontaminated, is in the eye of reason, always exalted even in her humility. Her immediate instinctive agencies, deriving wisdom unmixed from its divine fountain, are only one degree less exalted than herself, in their vicarious character. Other sources of instruction must be sought, which having neither the originality of inanimate objects, nor the promptings of unsophisticated instinct, happen to enjoy opportunities and experience, better than those of the philosopher in his schools. The ways of plodding industry in its humblest employments, must occasionally be trodden by those who are at home on the summit of the hill of science. The hand must be able and accustomed to perform some of the menial offices of philosophy, that its minutest details may be understood, and that examples may be set which none may fear to imitate. It was a wise rule of Turkish despotism, that the sovereign should spend a portion of every day in some mechanical employment. Mahomet IV. was deposed because he refused to conform to this salutary rule. We learn from authority so good as that of Sir George Staunton, that the Emperor of China once every year directed the plough through a piece of ground, dressed as a husbandman, to reconcile the farmer to his occupation. Charlemagne ordered that his children should be instructed in some profession. The Emperor Augustus is said to have worn no clothes but such as were made by the empress or her daughters: and Olympia, the mother of Alexander the Great, performed the same office for her warlike son. Is it a fanciful suggestion of the author of a book of much interest, which traces the dignity of mechanical employments beyond the flood? He insists that Adam was a gardener, Abel a shepherd, Seth a weaver, Enoch a tailor, and Noah, (undoubtedly!) a shipwright. There may be situations in the life of any man, when the might of learning may become of little comparative use, and when the hand being turned to its primitive employments, becomes the master instead of, and in preference to, the head. Who does not admire among the brilliant accomplishments of some of his charming female friends, their skill and frequent exercise in the use of the needle; a purely mechanical employment, and which of those charming friends is without a greater or less degree of excellence, in a faculty which she shares with the humblest of her domestics?

Our researches will sometimes discover a high degree of mechanical taste and aptitude for performance in unexpected quarters. It would

scarcely occur to those who are familiar with the productions of exquisite and luxurious refinement in manual art, to seek for instructors in the heart of Southern America, and there among the children of primitive simplicity. Yet they would not look for it among them in vain. The Indians of Peru, occupying the Sierra, which includes the valleys between the Cordilleras and the Andes—the Serranos as they are called—are said, by the latest travelers, to have attained a high degree of perfection in handicraft employments. As goldsmiths, according to the work of Von Tschudi, they are remarkably skilful, and in this branch of industry they produce work, which, for taste and exquisite finish, cannot be excelled in the capitals of Europe. Various kinds of vessels and figures of silver wire—filigranos is the name they bear—made by the Cholos in Ayacucho, have always been favorite articles of ornament in Spain. The Indians of Jauja are very skilful in working iron. Of leather also, they make various things in beautiful style. A circumstance, not inappropriate here, is quoted by the learned biographer of Nathaniel Bowditch, (whose father, it may be remarked, was a ship master turned into a cooper,) from Baron Zach's "*Correspondance Astronomique*." The Baron, with all the world, went to visit Mr. Crowninshield's splendid packet, the "Cleopatra's Barge," on her arrival at Genoa, in 1817. On learning from the Captain's son, a pupil of Bowditch, how little was the error, in their reckoning, in making the Straits of Gibraltar, he inquired how they got their longitude so accurately. The answer was, "First by our chronometers, and afterwards by lunar distances." The Baron expressed surprise, and somewhat unkindly observed, "Do you know how to take and calculate the longitude by lunar distances?" The young navigator replied, "Why our *cook* can do that; there he is," pointing with his finger to a negro at the stern of the ship, with a white apron before him, and holding a chicken in one hand, and a butcher's knife in the other. "Come forward, Jack," said the Captain, "the gentleman is surprised that you can calculate the longitude; answer his questions." The Baron asked him what method he used to calculate the longitude by lunar distances? His answer was, "It's all one to me: I use the methods of Maskelyne, Lyons, Mitchell and Bowditch; but, upon the whole, I prefer Dunthorne's; I am more used to it, and can work with it quicker." The foreign astronomer declares that he saw all this negro's calculations of the latitude, the longitude, and the true time, which he had worked out on the passage; and that all his questions were answered by him with wonderful accuracy, not in the Latin of the Caboose, but in good set terms of navigation.

Connected, if not identified, with the principle of humbleness, which is another word for conviction that knowledge does not disdain the lowliest bed, is the principle of docility. Innate parts are obviously unequal. Whatever may be the cause, it is impossible to doubt that inequalities exist among untutored human intellects, and in the facilities of acquiring instruction. *One* may receive the electric spark of wisdom, while *another* gropes his way tediously through dark and gloomy paths in pursuit of her celestial light. But all must be content to

learn. Inspiration, in its literal sense, belongs to none. With this quality in the learner, a desire to know, and willingness to be taught, it is not too much to say, that a due degree of valuable acquisition may with certainty be made. Nature not only opens her store-house of instruction to universal use, and places the key in the hand of every one who earnestly desires to possess it, but she facilitates the accomplishment of her generous purposes, by applying her suggestions to use, and sustaining them with resources adapted to local wants and capacities. Who can doubt the destiny of our own commonwealth and the duty of her sons? Her stones are iron. Her soil teems with subterranean fuel, bursting the solid entrails of the earth, along with the strongest, hardest, most abundant, and most useful of metals, and rendering it as malleable and far more valuable than the Ophir gold. Together they are the great means of manufacturing industry. They utter from the ground a voice, which nothing but wilful error can misinterpret, more prophetic and persuasive than an oracle. Let the rich jewel sparkle in the royal diadem that loads the brow of the monarch of its native soil. We will neither envy its possessor, nor desire to exchange for it our less brilliant productions. A single diamond found in Brazil, estimated at £224,000 sterling, graced the crown of Portugal. More than three hundred and seventy diamonds are said to belong to the British crown, supposed altogether to be worth £111,600. One ton of iron, wrought into the mechanic uses, which many a specimen about us modestly exhibits, has, in our eyes, a worth, intrinsic and extrinsic too, which surpasses that of all the diamonds ever mined. It makes both spears and pruning hooks; is the material alike of the sword and the ploughshare. Its moral uses are still more exalted. It cultivates a spirit of honest industry, rewards the hard hand of labor, stimulates ingenuity, promotes national independence, advances the progress of useful knowledge, gives comfort and convenience to society, and zest and safety to the enjoyments of life, and above all, stamps the character of the age as one of solid substantial merit, above and beyond all that former times, in their wildest fancies, hoped for or conceived. What strange perverseness seized the ancient poets when they placed the iron age last and lowest in the catalogue of time! Silver and gold are in truth the inferior metals to every useful purpose. One of the best of the ancient classics doubted whether the gods might not have denied them in mercy to mankind. Iron is the metal of sound philosophy, universal science, and advanced civilization. Apollo never would have given Midas asses' ears if he had wished by his touch to turn every thing into iron instead of gold. The primitive inhabitants of Brazil used fish-hooks of gold, merely because they thought they could do no better: and they abandoned the practice when they found that the right material abounded in their soil.

Of all the varieties of the Carbon family (to which the diamond belongs,) the diamond is intrinsically the least useful. It derives its charm only from its scarcity. It will not even burn, but with great persuasion, while its brethren of the coal tribe perform their duties with alacrity. The little piece of plumbago at the end of a scarcely larger

piece of stick which form together an ordinary lead pencil, is a twin brother of the diamond. In describing a scientific memorandum or friendly suggestion, it performs an office quite as interesting as that of its more admired relative. We sometimes hear, in praise of the writings of authors of genius, that they are as brilliant as if they were written with a diamond. As it was said of the words of Rousseau, that they were so warm as to burn the very paper on which he wrote. The pencil in daily use, the point of which is scandalized by the universal name of black lead, has nothing of lead about it, but is in reality the same generic substance as the gem of royalty. Half a dozen philosophers, we are told, can make the world believe any thing: and unhappily when they have once created error, it is not without time and effort that it can be dispelled.

Preferring our own productions to what the world is pleased to call the precious metals, and precious stones, let us derive consolation from what we have. Coal is the agent of mechanism, iron the material on which it operates, and steam the power by which its effects are produced.

One is struck with the application of some of these endowments to purposes for which at a former period they scarcely seemed designed. In constructing boats to float upon the water, lightness of the material was deemed a necessary ingredient. Specific gravity is proved to be no longer worthy of consideration if buoyancy be attained. Ponderous substances are as capable of performing the other offices of timber and at the same time of withstanding perils by which vessels of timber would be speedily destroyed. When a small detachment under the auspices of the navy department recently visited the Dead Sea and sounded those asphaltine depths which continue to involve the impenetrable mysteries of the guilty cities of the plain, they carried with them from the shores of the Mediterranean two metal boats, one of copper, which was mistaken by the natives for gold, and one of iron; and they purchased the only wooden one that was to be found on the sea of Galilee. In descending something like a thousand feet of cataract along the almost sanctified waters of the Jordan, their timber bark was shattered. Those of metal defied and triumphed over opposing precipices, and proudly bore the banner of their country on and through the dangers of the river, until it floated in melancholy grandeur on the surface of that sea, whose doomed waters sustain no life within their bosom. Thence the little boats were conveyed in safety back to the government ship to which they belonged, not materially injured by the hardships they had undergone.

A becoming modesty has been commended to the votaries of science of every class; but abatement is not therefore needed of proper self-respect. The two properties are compatible and of mutual advantage. Modesty is the crown of merit, and merit is in most instances the fruit of modesty. A sense of present deficiency prompts to exertion in order that it may be supplied, while toilsome acquisition satisfies us how much we owe to labor, and how humble would be our pretensions stripped of what we have acquired. Cultivated merit can scarcely fail to aspire to

distinction, which is its incentive to exertion. Nature in prompting to honorable efforts and placing within reach the means of improvement and assurances of accomplishment, exacts in turn a faithful, steady and zealous performance of every thing that is necessary to develop her resources, and thus to manifest our gratitude and to deserve success. In far better language than our own,

> "Spirits are not finely touched,
> But to fine issues; nor nature never lends
> The smallest scruple of her excellence,
> But like a thrifty goddess, she determines
> Herself, the glory of a creditor,
> Both thanks and use."

Yet another faculty of fitness to surrounding objects is requisite, in order to give full effect to improvement. It was not enough that whole empires should be penetrated by navigable waters, and that means should be at hand to ascend their impetuous floods. It was not enough that metallic ores should abound, coupled with mineral agencies to give them shape. All the riches of a luxuriant soil would rest in unprofitable inactivity, and all the means for diffusing them in transformed and practicable existence over a smiling land, would stagnate in repose, if *men*, with suitable tempers and tendencies, did not present themselves, to fashion and apply them. The faculty of matter is nothing without the faculty of mind. Willing hands must dig up the shapeless ore, and ingenious and active minds must metamorphose it into the material of mechanism, and then mould it into its thousand instruments, and with those instruments create the thousand fabrics for the perpetually increasing demands of civilized life. The works of nature expand and multiply with the wants of society and the ingenuity of mankind. Look around you, and behold them in almost infinite variety of elegance and character and use.—Say, if you can, which of them all in its present state of beauty and apparent and approaching perfection, does not owe its finished condition to the pure elements bestowed by Providence, either as ingredients and component parts, or as necessary tools and instruments in accomplishing the results,—combined with human skill and industry. This is the whole secret of mechanic art. Nothing is available without a combination, which indicates that the two things were made for each other, and that each must be kept in vigorous and active exercise together.

Fortunately enterprise is the distinguishing property of our countrymen. The indulgence of it is as diversified as the faculties or the desires of men. Some pursue the game of the great deep, and bring home from the bosom of distant seas their hard earned spoils. Others seek the forest, and delight to act the pioneers to civilization among the perils of Indian warfare and uncultivated wilds. Many hold the plough, and enjoy the luxuries of agriculture. Not a few chain their adventurous spirits to the anvil, the lathe, the crucible, the furnace and the loom, and breathe an atmosphere of labor, surrounded by almost untasted refinements that are supposed to belong especially to city life. But all are active, and numbers are keenly alive to the resources within their reach. More anxious and active spirits probably breathe here

than in any other part of the world. Restless and almost countless numbers vie with each other in struggles for distinction in some new discovery or untried exploit. A disposition so marked as belonging to ourselves, would seem to be derived from the adventurous character of that bold mariner who dared to explore distant seas, and brought European experience and civilization to these unknown shores. The destiny of nations has often been stamped by the tendencies of their founders. Rome did not more completely justify her warlike inheritance in her long annals of conquest and renown than these republics their ancestry in Columbus in the daring pursuit of new discoveries which distinguish their sons. They never tire in emulating by infinitely diversified efforts that exploring spirit which spurned the trodden paths of geographic knowledge, and firmly resolved to find in an unknown and almost unimagined world the foundation of empires, the latest, if not the brightest, in that bright circle of civilization which has been expanding ever since time began.

To meet the enterprising tendencies of our people, provision is made by fundamental law for promoting the progress of science and useful arts, by securing to the ingenious for limited times the fruits of their ingenuity. The genius of our institutions does not stop there in its encouragement. It facilitates the acquisition as carefully as it provides for the existence of this stimulating security. No where are the temptations to originality so abundant or so freely brought home to the enterprising as among ourselves, whether the exuberance of encouragement be for good or evil. Legislation anxiously directed to the object is at once co-extensive with the Union, and every where uniform in its invitations through all the sovereignties of the wide spread confederacy. The judicial tribunals of the country, actuated by a corresponding sentiment, and faithfully disposed to carry out the benevolent designs expressed in the constitution and the laws, have always given the most liberal interpretation to the language of both, in favor of the inventor. All things concur in happy contribution to the mass of inducement which has not failed to produce competition which is unequaled elsewhere. It would not be fanciful to believe that this combination of natural advantages and the constitution and laws with judicial concurrence and strong public sentiment; in other words that patents and the general support of them, are among the most valuable promoters of national advancement. Some nations are stationary and have undergone little or no change in their condition for centuries. Others have degenerated and fallen lower and lower in civilization. Patents by quickening the latent energies of these stubborn races would have served to prevent their degradation if the people could have profited by the encouragement which they afford. Without such provisions we are in no similar danger. With them, under proper regulations the career of improvement is likely to be as rapid, as the subjects of improvement and protection are numerous.

A patent is obtained where it is deemed due at the smallest possible expense. If the claims to originality appear on examination to be doubtful or ill founded, the applicant is at liberty to withdraw his application, and two thirds of the very moderate fee which he has paid are

returned to him. Every opportunity is afforded for impartial scrutiny. If at last an official ordeal be passed and the inventor is fortified with the seal of government, no barrier is interposed by it to individual contest, and, it may be, to eventual overthrow. The pretensions of a holder of a formal patent are still open to free objection and defeat. A concealment of the truth as to the alleged discovery, or complicating a description with unnecessary and superfluous matter with a view to deceive, or want of originality and priority, even in actual discovery or invention; or description of it anterior to the supposed discovery of the patentee in some public work; or a prior public use or sale of it; or surreptitious or unjust practice in obtaining a patent, for that which in fact belongs to another; fair and timely notice being given of any of these allegations, will avoid the grant and cause the patent thus unworthily held, to be cancelled. While serious injury is prevented to the public by monopolies, and to individuals by interference with a lawful use of what should be open to every one; while precaution anticipates, and subsequent opportunity is afforded for correction and redress of inadvertent error; the number of patents applied for and actually obtained is large. This is to be imputed rather to the character of the people than to any undue facilities in obtaining them which are less than might at first be supposed. 1531 applications were made in the year 1847. 572 patents were issued during that period including those standing over from the previous year. Among them there is of course infinite diversity. They vary in every degree of modification from "twine stands for counters" to "cannons," from "fish hooks" to "improved steam engines." No end seems to be yet in view to the attempted perfection of these last invaluable machines. Whistles, and valves, chests, pipes, pistons and stop cocks, are thrown up by the fires of invention like pieces of matter from the entrails of a volcano. Yet fatal accidents alarm us daily in spite of hundreds of positive preventives and assured reliefs. The frequency of application and grant may be understood from the fact, that although the expenses of the office are not small and the fees charged to applicants are so inconsiderable, a surplus of fund derived from these causes amounted, on the 1st of January, 1848, to $207,797·98.

The application of these remarks will be seen when it is understood that the Commissioner of Patents, in his last interesting report made to Congress, considers his office "as the head and representative of the inventive genius and the industrial arts of the country." Without any desire to question the justice of this claim, it may be maintained that the Institution which has brought together all these specimens of home manufactures is an efficient coadjutor. It cherishes true merit and affords early, ample and favorable opportunity for display, comparison, encouragement and correction. Having taught the elements of science, chemistry and the various departments of experimental philosophy, every thing that in the sphere necessarily allotted to it can elevate and embellish mechanic skill, it kindly interposes to restrain the exuberance of inventive genius by awakening at once keen perception and wary distrust; and it endeavors to guard against painful disappointment, as well as to foster prudent hope.

These creditable and well sustained efforts are directed immediately to the improvement of individuals who have already entered on a career of labor; individuals, young indeed, but with habits in some degree formed by a sort of education or the want of it earlier in date than the influences of the Franklin Institute. Aptitudes even with them, may be imperfect or totally wanting, in consequence of the absence of suitable preparation at a still more flexible period of youth or boyhood. Might not the like influence be carried farther back than the age of apprenticeship to which they now extend? Taste is a faculty of early growth. It is a faculty not only susceptible of high cultivation, but one that without cultivation has scarcely any available existence. It is acquired by opportunity and observation rather than actual study; from models made familiar in constant intercourse rather than formal rules. Yet, when acquired, it is infused into all the exercises of mechanic industry. External proportion, symmetry and grace, can become ingredients of useful objects, as well as the sterner properties of strength and durability. To a certain degree the effect is produced already. But it may be carried still farther, and scholars may be found ripe for instruction at the loom, the anvil, and the workshop, with experienced masters, and in the lecture room and the conversation hall, with brother manufacturers and learned professors, with nothing to unlearn. The benevolence of Mr. Girard might, in aid of his clearly expressed wishes and without any change in its arrangements, furnish a nursery for this plan. The pupils of his magnificent charity will naturally be calculated for mechanical employments. It would spoil them to distort them into professional men. With an eye directed to their subsequent career, from the very beginning of their almost infant course, all the discipline they receive, might well adapt itself to the character of instruction and employment, which this institution endeavors to promote. Under judicious preparatory pupilage, the young mechanic having passed through his initiate stage, would come to his labors with double aptitude. He would be trained to master the difficulties of honorable employment, and to elevate its standard by suitable embellishment. Things useful acquire new attraction when they become beautiful. With the ancients, utility was regarded as the source of beauty. At all times, the two qualities without any interference may be profitably combined.

It is presumption in one so little skilled, to bespeak occupations or to foretel developments for those whose benevolence has made them active, and whose experience has made them wise. The merits of the Franklin Institute are written in the history of its transactions. No pledges of usefulness in the future are needed beyond those of past performance. In the vast laboratory of Nature, ingredients are deposited for the uses of yet unborn philosophy. Time, which is the great unraveller of mysteries, will at the proper moment make them known. Ages will not exhaust them. Let us hope, that when this generation shall have closed its valuable labors, successors supplied with ample materials, may be found to emulate its zeal and fidelity.

INDEX.

List of American Patents, with Remarks, &c.